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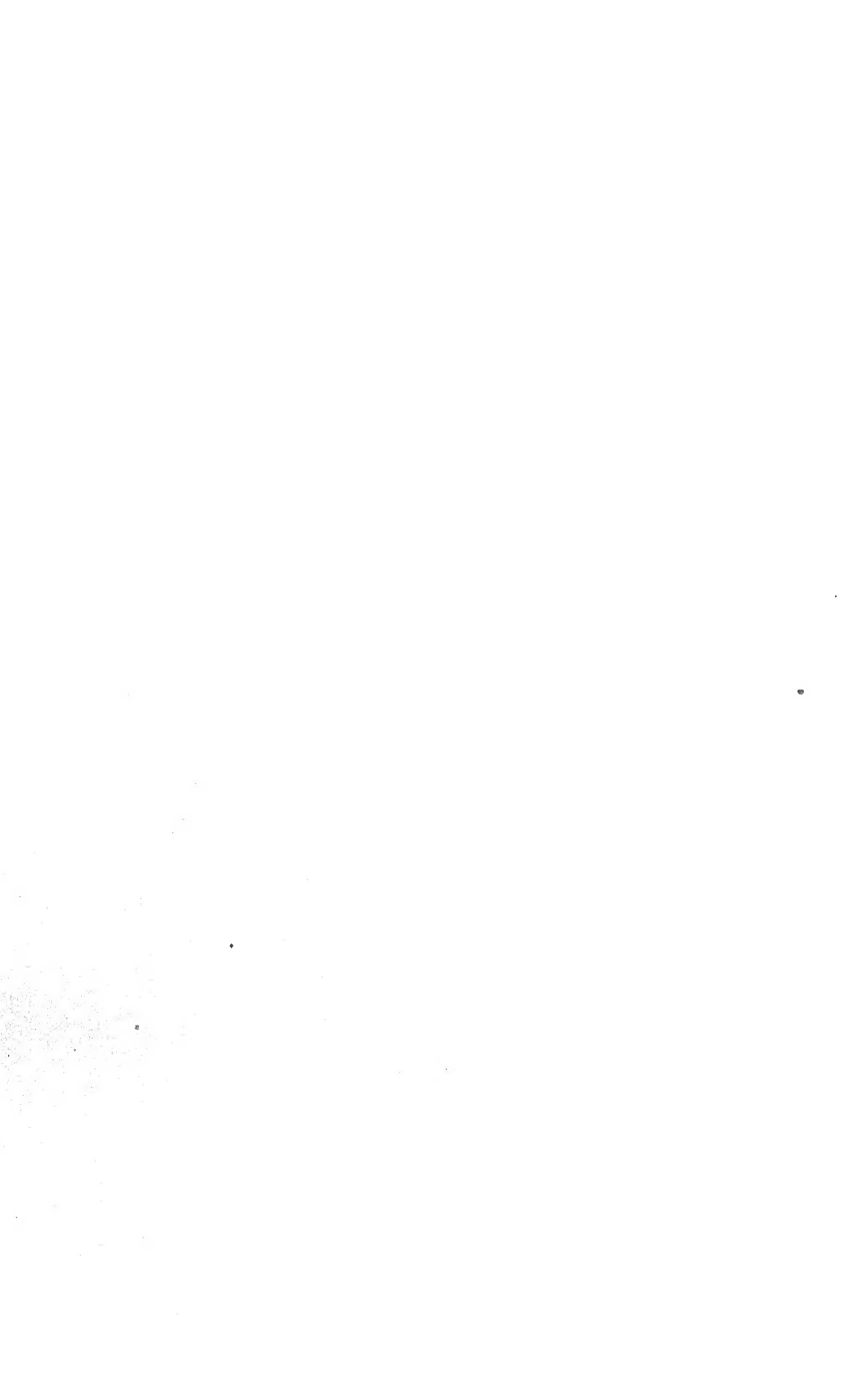
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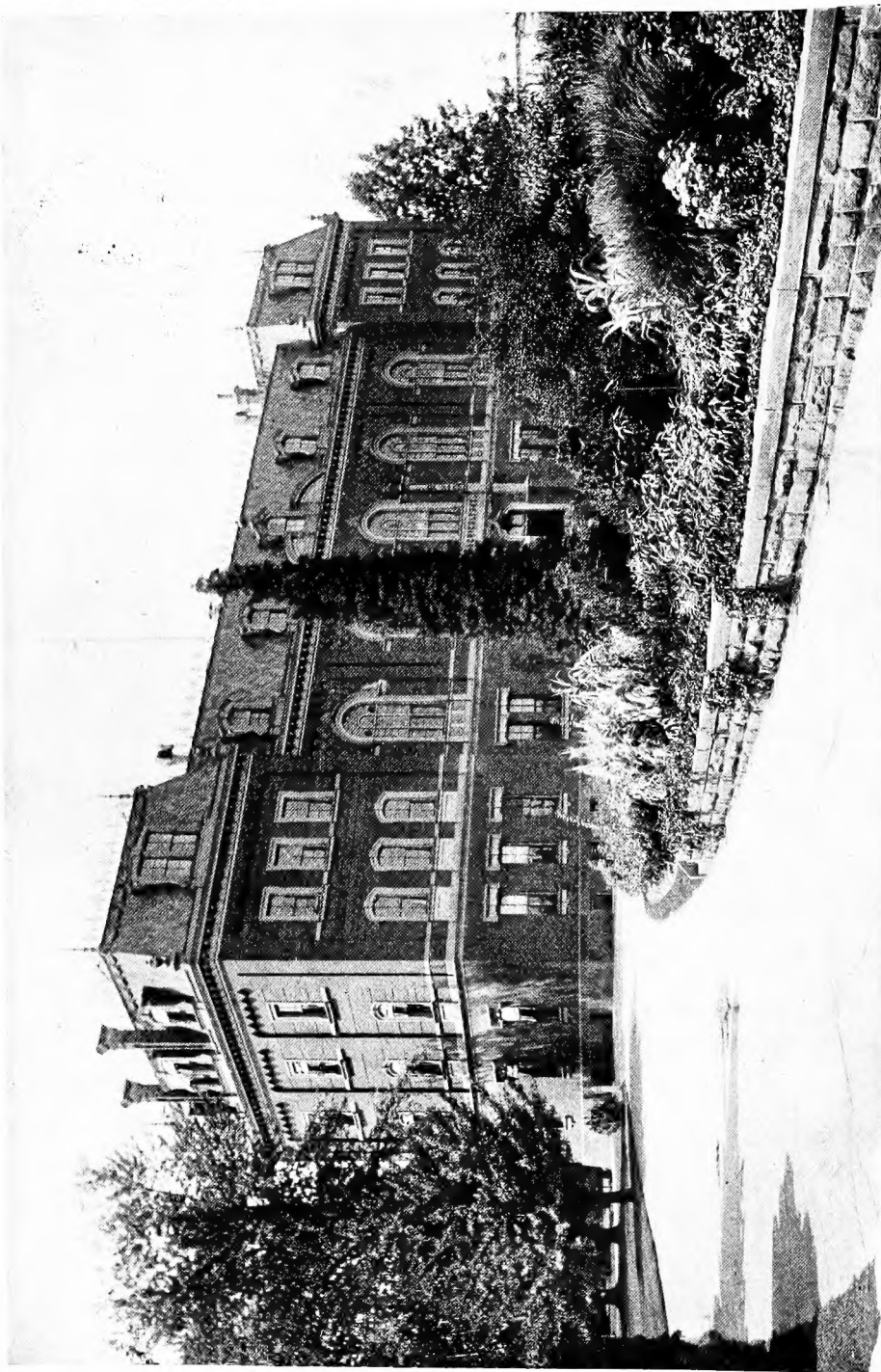
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U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF PUBLICATIONS.

HISTORICAL SKETCH

OF THE

U. S. DEPARTMENT OF AGRICULTURE;

ITS OBJECTS AND PRESENT ORGANIZATION.

COMPILED BY

CHARLES H. GREATHOUSE,

Division of Publications.

Under direction of

GEO. WM. HILL,

Chief of Division of Publications.



WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1898.

no. 1743

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF PUBLICATIONS,
Washington, D. C., February 28, 1898.

DEAR SIR: A frequent demand for information regarding the origin and development of the Department of Agriculture led to the compilation of the accompanying historical sketch. The compiler, Mr. C. H. Greathouse, of this Division, was instructed to follow as closely as possible, in the selection of subjects mentioned, the annual reports of the several Commissioners and Secretaries, prominence being given to those features of the work of the several administrations which the administrators themselves seem to have regarded as specially worthy of attention.

This historical sketch has been supplemented with a statement of the origin and duties of the several bureaus, divisions, and offices of the Department, in which the several chiefs have concurred, and by citations from the several laws under which the Department has attained its present stage of development.

I recommend this sketch for publication as Bulletin No. 3 of this Division.

Respectfully,

GEO. WM. HILL,
Chief.

Hon. JAMES WILSON,
Secretary.

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21.
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no. 3 -

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HISTORICAL SKETCH

OF THE

UNITED STATES DEPARTMENT OF AGRICULTURE.

ORIGIN AND DEVELOPMENT.

EARLY GOVERNMENTAL AID OF AGRICULTURE IN AMERICA.

The Department of Agriculture had its origin in the farsighted wisdom of Washington and the practical activity of Franklin. The former as President suggested the organization of a branch of the National Government to care for the interests of farmers, and the latter, when the agent of Pennsylvania in England, sent home silkworm eggs and mulberry cuttings to start silk growing. When the representatives of the new United States Government went to foreign lands after the Revolution they followed Franklin's example. The number and value of their contributions increased till Hon. Henry L. Ellsworth, of Connecticut, in 1839, induced Congress to make a trial of a small appropriation for the distribution of the seeds, cuttings, etc., thus collected, and for the publication of agricultural statistics. The experiment was successful and the work of the Department has since had a steady growth.

Governmental aid to agriculture, however, antedated the time of Washington and Franklin, though it was desultory and uncertain. James I, in 1622, encouraged the breeding of silk worms in Virginia; in 1642 the general court of Massachusetts offered premiums for sheep raising, and in 1657 the Virginia legislature passed an act to stimulate the raising of hops. In 1732 a parcel of government ground in Georgia was allotted for growing mulberry trees in aid of the silk culture, and in the ten years preceding 1743 Parliament granted \$600,000 to promote the cultivation of indigo and other crops in Georgia. In 1748 Parliament put a premium on silk culture in the colonies, and in 1766 the South Carolina assembly voted £1,000 for the establishment of a silk filature in Charleston. In 1775 the South Carolina and Virginia legislatures were taking steps to encourage the sheep industry, but the Revolution came on, and all special efforts in behalf of agriculture were lost sight of.

After American independence had been won and peace was firmly established strong friendships grew up between public-spirited Englishmen and Americans. When the British board of agriculture was established in 1793 its chief promoter, Sir John Sinclair, had his friend and correspondent, President Washington, made an honorary member. To a suggestion that a similar board ought to form part of the American Government Washington was favorable, but in his reply to Sir John, in a letter of July 20, 1794, showed his clear understanding of the order of growth of public institutions. He said: "It will be some time, I fear, before an agricultural society with Congressional aids will be established in this country; we must walk, as other countries have done, before we can run. Smaller societies must prepare the way for greater, but with the lights before us I hope we shall not be so slow in maturation as other nations have been."

WASHINGTON'S VIEWS AS TO A BOARD OF AGRICULTURE.

In order to bring the matter before the public Washington, in his last message to Congress, on December 7, 1796, made the following statement of his views: "In proportion as nations advance in population the cultivation of the soil becomes more and more an object of public patronage. Institutions grow up supported by the public purse. * * * Among the means which have been employed to this end none have been attended with greater success than the establishment of boards composed of public characters charged with collecting and diffusing information, and enabled by premiums and small pecuniary aid to encourage and assist a spirit of discovery and improvement. This species of establishment contributes doubly to the increase of improvements, by stimulating to enterprise and experiment, and by drawing to a common center the results everywhere of individual skill and observation and spreading them thence over the whole nation."

RECEPTION OF WASHINGTON'S SUGGESTION.

This suggestion was seconded by Col. Timothy Pickering, Secretary of State, and was favorably received by public men generally. The response of the Senate, drawn by Senator Read, of South Carolina, was as follows: "The necessity of accelerating the establishment of certain useful manufactures by the intervention of legislative aid and protection and the encouragement due to the creation of boards (composed of intelligent individuals) to patronize the primary pursuits of society are subjects which will readily engage our most serious attention."

The House of Representatives referred the subject to a committee, which reported on January 11, 1797, recommending the creation of such a society as indicated. It was to meet annually, and Congressmen, Federal judges, the Secretaries of State, War, and Navy, and the Attorney-General were to be ex-officio members. The bill was read twice and on the next Monday was taken up for consideration. But a

discussion of direct taxes brought a conflict of opinion between city and country members; also Jefferson opposed the recommendation for a military academy, which was associated with this proposal, on the ground that it was not authorized by the specific powers delegated to Congress by the Constitution. The friends of the measure feared to allow it to come to a vote, and it was never further debated.

A similar unsuccessful attempt was made in 1817. In answer to a memorial from the agricultural society of Berkley, Mass., presented on January 29, Mr. Hulbert, chairman of the special committee to which the matter was referred, reported a bill on February 21 for the establishment of a board of agriculture. The bill was committed to the Committee of the Whole, but got no further. Madison's Administration closed on March 4 following, and that time was too near at hand to undertake new legislation of such importance.

WORK OF AMERICAN REPRESENTATIVES ABROAD.

But while Congress was waiting for an opportunity for full deliberation on the subject, consuls and naval officers abroad were sending home seeds and cuttings for new crops and aiding in the introduction of new breeds of domestic animals. During Washington's last Administration William Eaton, consul at Tunis, sent to Timothy Pickering, Secretary of State, several Barbary sheep. They came by an armed vessel in the United States service, commanded by Henry Geddes. Mr. Pickering presented a pair of the sheep to the president of the Philadelphia Agricultural Society, and from these the breed spread throughout Pennsylvania and adjoining States.

In 1810, William Jarvis, United States consul at Lisbon, took advantage of the Napoleonic wars to secure thousands of Merino sheep for this country. The Spanish noblemen who owned the sheep had up to that time been slow to part with their pure-bred stock, as they had a practical monopoly of the finest grades of merino wool, but when the French armies were destroying the flocks they were glad to sell them to the Americans. Also, Chinese and French hogs were introduced early in the present century by such aid of American officials.

During the Administration of President John Quincy Adams directions were given to all United States consuls to forward rare plants and seeds to Washington for distribution, and the Botanical Garden was established. In 1826 Congress authorized the publication of a manual, prepared by Richard Rush, Secretary of the Treasury, containing the best practical information that could be collected on the growth and manufacture of silk. In 1828 Count Von Haggi's "Treatise on Rearing Silkworms" was printed as a Congressional document. Several valuable reports on the silk industry were also made and published about this time.

AGRICULTURAL DIVISION OF PATENT OFFICE.

In 1836 Hon. Henry L. Ellsworth, of Connecticut, Commissioner of Patents, received from Government representatives abroad and from others considerable quantities of seeds and many plants, and distributed them to enterprising farmers throughout the country. This he did without Government authority or aid further than the use of the franks of Congressmen who were his personal friends. He also urged in his report that the Government take up the work of aiding agriculture in this and other ways.

FIRST APPROPRIATION BY CONGRESS.

His suggestions and arguments led to the appropriation in 1839 of \$1,000 for the purpose of collecting and distributing seeds, prosecuting agricultural investigations, and procuring agricultural statistics. The



HENRY L. ELLSWORTH,
Commissioner of Patents.
1836-1845.

money was to be taken from the Patent Office fund and the work was to be done under the Commissioner, at that time an official of the Department of State. In his report, made in January, 1841, Commissioner Ellsworth stated that 30,000 packages of seeds had been distributed during the year and that agricultural statistics, as gathered in the census, were being prepared for publication. In 1842 these statistics were published, with a survey of crop conditions and prospects. Progress in agricultural science was reviewed and special notice was made of the

manufacture of sugar from Indian corn and the use of lard oil in place of whale oil for lighting. A firm, it was stated, was seeking to make a contract to supply the light-houses on the Great Lakes with maize oil.

GROWTH OF THE WORK IN THE PATENT OFFICE.

The distribution of seeds and the collection and publication of agricultural information continued under succeeding Commissioners of Patents. These were Edmund Burke, of New Hampshire; Thomas Ewbank, of New York; Silas H. Hodges, of Virginia; Charles Mason, of Iowa; Joseph Holt, of Kentucky; William D. Bishop, of Connecticut; Philip F. Thomas, of Maryland; S. T. Shugert; and David P. Holloway, of Indiana. In 1849 the Department of the Interior was established, and the Patent Office, with its agricultural work, became a part of it. The collection of seeds and publication of agricultural statis-

tics and scientific articles was directly under the care of the Commissioner until that time. No clerk was especially assigned to the duties. In that year the name of F. G. Skinner, who had been publisher of the *American Farmer* at Baltimore, appears in the *Official Register* as collector of agricultural statistics, at \$1,500 a year. In 1851 it had been found advisable to secure a man of high scientific attainments, and Dr. Daniel Lee, of Georgia, was employed, at \$2,000. In 1853 the salary was reduced to \$1,500 again, and D. J. Browne, of New Hampshire, was employed. In 1855 Mr. Browne's salary had been made \$2,000, and C. L. Alexander, at \$3 a day, was assigned to the same work. In 1857 the roll stood: D. J. Browne, \$2,000; T. Glover, New York, \$2,000; H. C. Williams, Virginia, \$2,000; C. L. Alexander, District of Columbia, \$1,200; W. H. Dietz, Pennsylvania, \$1,000; Thomas Donoho, District of Columbia, and Jos. Kilian and C. Simmons, Maryland, each \$3 a day.

Mr. Browne was succeeded, on change of Administration in 1861, by Isaac Newton, of Pennsylvania. David P. Holloway, of Indiana, became Commissioner of Patents at that time, and in his first annual report made an earnest argument for the establishment of a separate department of the Government to deal with the interests of agriculture and productive arts.

ORGANIZATION AND WORK OF INDEPENDENT DEPARTMENT.

The subject of an independent department was immediately taken up in Congress and the necessary legislation enacted practically without opposition. The law* was approved May 15, 1862. The United States Agricultural Society, organized in 1852 and meeting in Washington annually from that time till 1860, was at all times active in urging the establishment of the department. It was largely instrumental in creating the public opinion which made this practical realization of the hopes of Washington so easily possible. It is noteworthy that in this same year, June 19, 1862, was passed the first act, known as the Morrill law, for the establishment of agricultural colleges.

COMMISSIONER NEWTON'S TERM.

The first Commissioner of Agriculture was Hon. Isaac Newton, already mentioned as chief of the section of agriculture in the Patent Office. He took charge in his new capacity on July 1, 1862, when the law establishing a department went into effect. He was a native of New Jersey, but early in life settled in Pennsylvania, where he devoted himself to scientific farming. Under his new appointment he was given full control of the property of the division in the Patent Office and conducted his work independently of the Department of the Interior. The propagating garden at Sixth street and Missouri avenue NW., in Washington, first mentioned in the annual report of 1858, was placed under his care and a tract of 40 acres in the same city, lying between

* The text of this and other laws will be found elsewhere. See pp. 41-52.

Twelfth and Fourteenth streets SW., and B street S. and the canal, the same now forming the Department grounds, was assigned to him for an experimental farm.

The organization of the new Department proceeded rather slowly at first. There was delay in the transfer of the property of the agricultural division from the Patent Office. Commissioner Newton said in his first report, dated January 1, 1863, that he was not yet formally in possession, though he had called attention to the matter in the previous July. Also on January 1, 1864, he said he had been unable to use the ground at Twelfth and B streets SW., as a farm, because it was needed by the War Department as a cattle yard for army supplies.

Appointment of early officials.—In 1862 Commissioner Newton appointed

William Saunders to be superintendent of the propagating garden, and Mr. Saunders aided materially with advice in organizing the departmental work. It was proposed to employ a chemist, and Mr. Saunders was asked what there was in his branch for the attention of such an official. He said that in the experiments with new varieties of grapes there were analyses which could be made with profit. On August 21, 1862, C. M. Wetherill was appointed Department chemist. He made certain analyses of grapes, and also of sorghum sirup, which



ISAAC NEWTON,
Commissioner of Agriculture.
1862-1867.

were given to the public in the second bulletin published by the Department. The first bulletin was a pamphlet by Mr. Saunders on the objects and aims of the Experimental Garden, with a catalogue.

This work and the distribution of plants from the propagating garden, the collection and distribution of seeds, and the publication of agricultural statistics and other information constituted the chief activities of the Department for the first six months.

In 1863 Commissioner Newton appointed Lewis Bollman to be statistician and Townend Glover to be entomologist. He imported several hundred bushels of choice seed wheat, corn, rye, and other cereals, and several thousand dollars worth of other seeds. At the same time with these he distributed 1,500 bushels of cotton seed and a large amount of tobacco seed. An especial effort was made to stimulate the cultivation of cotton in the Northern States. In all, Commissioner Newton distributed in 1863 1,200,000 packages of seed and 25,750 bulbs, cuttings, and vines. The publication of monthly reports of the condition

and prospects of crops was begun. A Maine farmer wrote soon after this was well under way: "Your monthly reports give me just the information I have wanted for years. Knowing the supply and demand I am able to sell at my own price."

Weather service and beet sugar inquiry suggested.—The study of the climate and storms of this country had long been fostered by the various Departments of the Government, and by the Smithsonian Institution as well as by several individual States before the act of 1862 establishing the Department of Agriculture. Commissioner Newton in his first and second annual reports dwelt on the vital importance of the weather and climate, and in his third report (1864, p. 10) said:

"I would renew my suggestion of last year that if under the direction of the Government the state of the weather at different points of the country could be daily communicated by telegraph, so as to be immediately spread over the whole country, very important and beneficial results might follow."

The publication of meteorological data gathered by Smithsonian observers was continued in the monthly reports of the Department from 1863 to January, 1872; but the suggestion of Commissioner Newton and special efforts made by many to induce the Government to establish a practical service for the prediction of storms and floods, resulted in the organization of a meteorological division in the office of the Chief Signal Officer of the Army, and finally, after thirty years, in the establishment of the Weather Bureau as it exists to-day.

In his third annual report, Commissioner Newton also called attention to the beet-sugar industry, as it had been developed in France, and suggested its adaptability to this country.

Death of Commissioner Newton.—The following summer (1865) he got possession of the land at Twelfth and B streets SW., and started the experimental farm. His son, Isaac Newton, jr., was placed in charge of this work. Tests were made that summer of new and promising varieties of corn, wheat, rye, oats, barley, rice, sorghum, peas, beans, grasses, clover, cabbage, lettuce, onions, tomatoes, potatoes, and melons. Seventy-seven varieties of potatoes were tried. A large quantity of seed was saved from the farm and distributed during the winter and spring.

In July, 1866, Commissioner Newton suffered a sunstroke while in the field on the experimental farm. A large number of varieties of wheat—Tappahannock, Mediterranean, and others now in general use—were being tried. The grain had been cut and was lying on the ground when a thunder shower suddenly appeared. Commissioner Newton was in his room at the Patent Office. He hastened over to the farm, a mile away, to instruct the workmen how to save the wheat free from any injury. The sun was hot and he was wearing a high silk hat. In moving hurriedly about the grounds he became overheated. His son took him to the little office on the farm and summoned medical assistance. Restoratives were applied and he partially recovered, but was never well again. He died from the effects of the injury on June 19, 1867.

During Commissioner Newton's time the foundations were laid for the Department library and museum. The first appropriation for the library was \$4,000, in 1864, for the library and laboratory jointly. The Glover collection was bought for the museum in 1867 for \$10,000.

After Mr. Newton's death Mr. J. R. Dodge, who had succeeded Professor Bollman as statistician, became very prominent in Department work and so remained for twenty-five years. He edited the Annual Reports and the Monthly Reports and wrote much of the most valuable matter that appeared in them.

COMMISSIONER CAPRON'S TERM.

John W. Stokes, chief clerk of the Department, was acting Commissioner after Mr. Newton's death till December 4, 1867, when Gen. Horace Capron, of Illinois, who was appointed on November 29, took



HORACE CAPRON,
Commissioner of Agriculture.
1867-1871.

charge. He was a native of New York, but in early life removed to Maryland where he became a farmer on an extensive scale, applying scientific principles to his operations. In 1847 his receipts amounted to more than \$36,000. In 1854 he removed to Illinois. There he continued farming, especially as a breeder of Devon cattle, till the civil war broke out when he enlisted in the army, where he rose to be a brigadier-general. After the war he returned to his farm, and at the death of Mr. Newton was selected by President Johnson to succeed him.

Commissioner Capron in his first report paid much attention to steam plowing, beet-sugar making, and the problem of silk culture. He established a system of exchanges of seeds and plants with many of the Governments of Europe, Asia, and South America. He had the chemical laboratory fitted up and made a large collection of native grasses, and forage and fiber plants from Colorado, Texas, New Mexico, and Arizona. In 1868 the Commissioner was asked by Hon. Seth Green, then fish commissioner in New York, by United States Treasurer Spinner and others to bring the possibilities of fish culture to the attention of Congress. A number of articles published at this time and in the years immediately succeeding made way for the United States Fish Commission.

The main building of the Department was completed and occupied during Commissioner Capron's term. There was favorable comment upon the fact that the cost was kept within the amount appropriated.

This was the first instance of the kind in case of so important a work.

An investigation of Texas cattle fever was made and Mr. Capron recommended the establishment of a division of veterinary surgery. The propagation of cinchona plants was begun with a view to introduce the culture in the warmer sections of the country.

Experimental Farm Given up—Division of Botany.—From the outset it had been recognized that the experimental farm at Twelfth and B streets was too small because of the mixing of varieties of seeds when cultivated close together. Mr. Stokes, in his report accompanying General Capron's, recommended that the farm be converted into an American arboretum. This suggestion was adopted the more readily because the new Department building was being erected on the grounds.

The Division of Botany was organized in 1868. It was upon the suggestion of Prof. Joseph Henry, of the Smithsonian, who stated that considerable quantities of botanical specimens were lying at the Smithsonian unmounted and that they could be made available to the Department of Agriculture if there were a botanist. The collection came from the Hayden and other explorations in the West and from the Japan Expedition. It was agreed upon further conference of those interested that a herbarium should be established in charge of the Department of Agriculture. C. C. Parry was appointed botanist to arrange and care for the specimens and to do other work in that line as it should arise.

The high standing of the Department before the world, as well as the leading position already attained by American agriculture, is indicated by the selection of the second Commissioner to direct the inauguration of improved methods of farming in Japan. That people was then at the threshold of the development which has placed it among the great nations. A commission had been appointed by their Government to develop agriculture, and they chose General Capron as chief adviser. He resigned the commissionership on June 27, 1871.

COMMISSIONER WATTS'S TERM.

Judge Frederick Watts, of Carlisle, Pa., was appointed by President Grant to fill the vacancy caused by the resignation of Commissioner Capron. He had been on the bench in the ninth Pennsylvania district before the war, but in 1858 abandoned the law for farming. He was a native of Carlisle, and a graduate of Dickinson College. He was the first president of the Pennsylvania Agricultural Society, and for twenty-seven years was president of the Cumberland Valley Railroad Company.

Commissioner Watts found in operation the Divisions of Chemistry, Garden and Grounds, Entomology, Statistics, and Botany. This brief roster affords an interesting comparison with that which represents

the Department organization at the beginning of Secretary Wilson's term, page 33 of this publication.

In his first report the Commissioner recommended that the number of copies of the annual report for gratuitous distribution be greatly reduced, and that the remainder be deposited with the Public Printer for sale at the cost of printing and postage.

The cultivation of ramie on an extensive scale had been undertaken in the South, and Commissioner Watts urged that planters should push this industry together with the raising of jute.

New work undertaken.—The Division of Microscopy was established in 1871 by the appointment of Thomas Taylor, Microscopist. Early among his services was an investigation of the cranberry rot in New Jersey. He also soon made a study of mushrooms, and suggested the cultivation of them as a profitable business. Other subjects

investigated by him were mildews on grapes, yellows in peaches, and black knot on plums.

Commissioner Watts was the first to give much attention to timber interests. He had sections of the most valuable trees of the country on exhibition at the Centennial Exposition, and in 1877 secured an appropriation for a forestry investigation. Mr. Franklin B. Hough, of Pennsylvania, was appointed special agent in charge of the work. This was a beginning of the Forestry Division which was fully organized several years later.



FREDERICK WATTS,
Commissioner of Agriculture.
1871-1877.

The Centennial Exposition brought large donations from foreign governments for the museum, so that the space allotted to it had to be nearly doubled. Contributions were received from Great Britain, Australia, Japan, Egypt, Norway and Sweden, the Netherlands, Brazil, Argentina, Chile, and Mexico. Large additions were also made about this time to the herbarium. Charles Richards Dodge, then assistant entomologist, estimated that the museum collections were worth \$100,000. Models of fruits and water-color drawings formed an interesting part of the display.

Weather reporting transferred to the War Department.—Commissioner Watts objected to the publication in the monthly reports of the meteorological summary and notes furnished by the Smithsonian observers without analysis and explanation, and suggested that the work be turned over to the Signal Service of the Army. In response Congress made an appropriation with which the War Department was directed

to collect and publish meteorological information for the benefit of agriculture.

The Division of Statistics at this time had about 3,000 voluntary correspondents. Commissioner Watts in his report for 1876 called attention to the fact that the appropriation for this division had been cut from \$15,000 to \$10,000, declaring that the work had been thereby greatly crippled. The appropriation was restored to the usual amount the following year. Commissioner Watts complained of delay in the publication of his annual report. He was also hampered by the abolition of the franking privilege for the distribution of the report.

The ravages of the grasshoppers in the West began about this time and the Department sent out \$30,000 worth of seeds to the devastated districts. This was under a special appropriation.

COMMISSIONER LE DUC'S TERM.

Hon. Wm. G. Le Duc, now of Hastings, Minn., was appointed Commissioner of Agriculture by President Hayes, and assumed control on July 1, 1877. He took strong ground against the indiscriminate distribution of common seeds. In his first annual report he cited the sections of the Revised Statutes bearing upon the subject, and pointed out in italics that the distribution "shall be confined to such seeds as are rare and uncommon to the country." It was plain, he urged, that the law did not contemplate the sending out of such seed as may be bought of seedsmen generally. He made a comparison of the small appropriations for the Department with the sums given other branches of the Government and asked for more liberal treatment. He also pointed out the need of a general index for the annual reports of the Department. Such an index, completing earlier indexes, was prepared last year in the Division of Publications by George F. Thompson.



WM. G. LE DUC,
Commissioner of Agriculture.
1877-1881.

Investigation of animal diseases.—Under a special appropriation of \$10,000 in 1878 Commissioner Le Duc directed an investigation of diseases among hogs and other domestic animals, and in his annual report called attention at length to pleuro-pneumonia among cattle, which had already secured a wide foothold in this country. The inquiry into animal diseases was kept up during his term with increasing energy. A careful study was made of glanders and farcy. At the same time an investigation of the history and habits of insects important in agriculture was maintained under a special appropriation of \$10,000, renewed by succeeding Congresses.

An international exposition at Paris took place at this time, and the Department received \$15,000 with which to make its exhibit. Professor McMurtrie, the Department chemist, was placed in charge. A creditable showing was made, though, as Commissioner Le Duc stated, the money was available too late to secure the best results.

Experiments with sorghum, and other work.—The production of sugar, both from sorghum and from beets, received much attention, and under a special appropriation for machinery, etc., considerable experiments with sorghum were conducted at Washington. Commissioner Le Duc was unable to obtain there a supply of properly grown canes, and asked for the purchase of 1,000 acres of ground in the vicinity upon which the Department might grow its own material for the experiments, and conduct an experimental farm. He also wished that auxiliary experimental farms should be established in each of the States.

Irrigation, which had received some attention in the report of 1874, was beginning to enlist much interest, and \$20,000 was appropriated by Congress in 1880 for experiments with artesian wells.

Commissioner Le Duc got an appropriation of \$15,000 for investigation of tea culture, and leased a farm in South Carolina for the purpose of experimenting, and to propagate plants for general distribution. He believed that a few years would develop a large industry of tea growing in the Southern States.

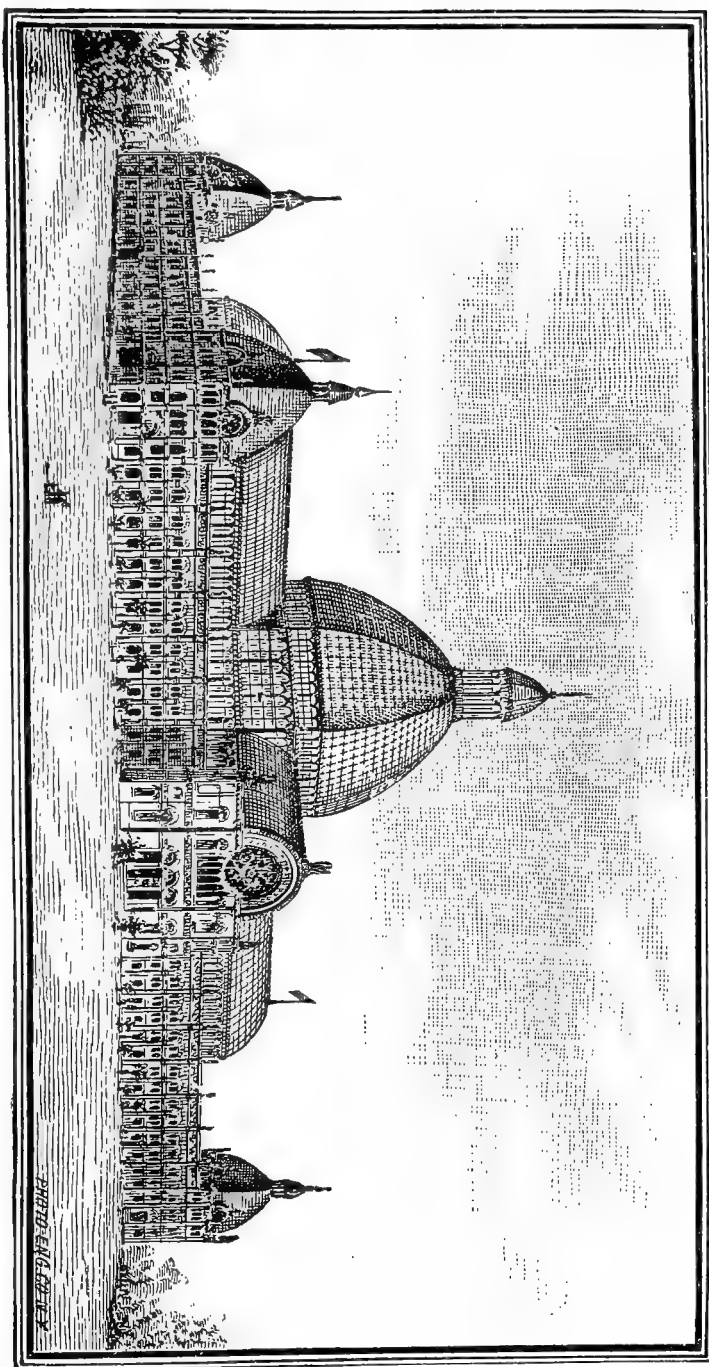
In spite of his opposition to the distribution of common seeds, Mr. Le Duc sent out, in 1877, 2,333,474 packages, of which 943,530 went to the district ravaged by grasshoppers. He also distributed 156,862 plants, cuttings, etc., from the propagating gardens, of which 70,000 were tea plants, 3,000 olives, 1,000 coffee, and 500 date palms.

Commissioner Le Duc recommended the erection of a larger Department building on the same site. The plans approved by him were for a structure in the form of a hollow rectangular parallelogram 500 feet by 1,000 feet, with an enclosed court for a display of agricultural implements. The view of the front of the proposed building here (Plate I) presented was published in the report of 1880.

COMMISSIONER LORING'S TERM.

Dr. George B. Loring, of Massachusetts, was appointed Commissioner of Agriculture by President Garfield, and took charge on July 1, 1881. He was educated as a physician, but was postmaster at Salem, Mass., for four years ending in 1857, and from that time devoted his time to scientific farming and politics. He was president of the New England Agricultural Society for twenty-seven years prior to his death in 1891.

In his first report he stated the work of the Department as he found it as follows: Investigations of tea planting, of sugar making from sorghum, of vegetable and animal fibers, of economic insects, of irrigation by the use of artesian wells, of diseases of domestic animals, and of the agricultural condition of the Pacific Coast.



DESIGN FOR DEPARTMENT BUILDING AS PROPOSED BY MR. LE DUC.

PHOTO-ENGRAVED

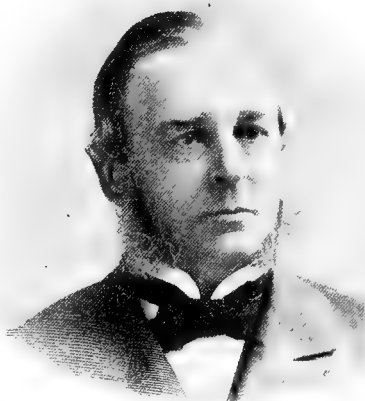
The tea farm, as shown in a report by Mr. Saunders, the Horticulturist, gave little promise, and Commissioner Loring cut down the outlay in that direction as much as practicable under the lease already made. The attempt to sink an artesian well at Fort Lyon, Colorado, undertaken under Commissioner Le Duc, was abandoned. Two other wells were started on railroad lines in the plains east of Denver. The sorghum experiments were brought to a close with disappointing results as to the production of sugar. A report was secured from the National Academy of Science on the history of sorghum experiments for twenty-five years. Experiments with sorghum sirup were continued by the chemist. The distribution of sugar-beet seed on a large scale was begun and the Division of Chemistry began a series of analyses to determine the possibilities of producing sugar from beets.

Origin of Bureau of Animal Industry.—Commissioner Loring gave especial attention to the diseases of domestic animals, and the appropriation for investigations in that line was more than doubled. A veterinary experiment station was established at Washington under D. E. Salmon. Inquiries were carried on in Maine, Connecticut, New York, New Jersey, Pennsylvania, Maryland, Virginia, Tennessee, Kentucky, Ohio, Indiana, Illinois, Missouri, Kansas, Arkansas, and Texas. The study of inoculation, which resulted in the discovery and use of mallein and other forms of vaccine made and distributed by the Department was suggested in the report for 1883. The control of quarantine against diseased animals was transferred to the Commissioner from the Treasury Department. In 1884 the Bureau of Animal Industry was established by act of Congress with \$150,000 to prosecute the crusade against pleuro-pneumonia and other diseases.

The problem of silk culture was taken up anew with an appropriation of \$15,000 in 1884. A special agent was appointed to conduct experiments under the direction of the entomologist.

The United States Entomological Commission was transferred to the Department of Agriculture from the Interior in 1881 and continued its reports on injurious insects.

Development of the work in statistics.—The Division of Statistics was reorganized, with a view to a more complete and perfect system of crop reporting. The appropriation was raised in 1882 to \$80,000.



GEORGE B. LORING.
Commissioner of Agriculture.
1881-1885.

"The design is," wrote Dr. Loring in his report, "by establishing a permanent system of efficient and prompt collection of current statistics to be able to present instantly and accurately the current changes in crop areas and conditions and in the production of breadstuffs, meats, industrial products, and all the results of agricultural labor."

The publication of transportation rates was begun in the monthly reports by the direction of Congress, and a European agency was established for the collection of statistics showing the prospective demand for American produce, especially grain and meats. E. J. Moffat was appointed as agent at \$2,500 a year. He had his office with the American consul-general in London.

The Bahia seedless oranges were propagated extensively in the conservatories at Washington at this time, and young plants were sent to California and other States. Mr. Saunders estimated that the Division of Gardens and Grounds was sending out yearly 100,000 plants of all kinds. Increasing quantities of seeds were distributed, reaching in 1883 a total of 2,467,230 packages, of which 76,232 packages were tobacco seed.

COMMISSIONER COLMAN'S ADMINISTRATION.

Hon. Norman J. Colman, of Missouri, was appointed Commissioner by President Cleveland and took his place on April 3, 1885.

Norman J. Colman was born near Richfield Springs, N. Y., May 16, 1827. He obtained an academic education, then went to Louisville, Ky., where he taught school, attended the Louisville Law University, took the degree of bachelor of law and his license to practice, and located at New Albany, Ind., where he began the practice of his profession in partnership with M. C. Kerr (his former room and class mate), who became Speaker of the House of Representatives of the United States and died while holding that office. They soon obtained a fine practice, and Mr. Colman was elected district attorney, which office he held one year, and then removed to St. Louis, Mo., continuing the practice of his profession. But having a strong love for rural pursuits, he purchased a country home, and began the publication of an agricultural paper under the name of Colman's Rural World. In the civil war he was a Union man, and lieutenant-colonel of the Eighty-fifth Regiment of Enrolled Missouri Militia. In 1865 he was elected to the Missouri legislature. In 1868 he was nominated by his party (Democratic) for lieutenant-governor, but with his entire party ticket was defeated. In 1874 he was again nominated for lieutenant-governor and was elected. He was a member of the board of curators of the State University for sixteen years. He was president of the State Horticultural Society, of the State Live Stock Breeders' Association, of the State Board of Agriculture, and of many other State and National associations organized to advance the interests of the farmer. In 1885, when appointed by President Cleveland to be United States Commissioner of Agriculture, he enlarged the sphere of the Department, adding several important divisions. Under his administration it became one of the Executive

Departments of the Government on February 11, 1889, and he was appointed by the President the first Secretary of Agriculture. On his retirement from the office Mr. Colman received from the President of the Republic of France, through its minister of agriculture, the Cross of "Officier du Merite Agricole," accompanied by a gold medal and the decoration of the order.

Office of Experiment Stations.—Mr. Colman took a deep interest in the plan being pushed at this time by Representative Hatch for the establishment of agricultural experiment stations in all the States. He called a meeting of the leading men of the agricultural colleges and existing experiment stations, at which the need of Federal aid for experiments and a central office in the Department with advisory duties, was made prominent. In accordance with the opinions expressed at this convention the Hatch bill, which became a law in 1887, made it a part of the duty of the Commissioner of Agriculture "to furnish forms for the tabulation of results of investigations or experiments; to indicate, from time to time, such lines of inquiry as to him shall seem most important; and, in general, to furnish such advice and assistance as will best promote the purposes of this act." For this purpose an office was established, known in the Department as the Office of Experiment Stations, under a chief who is styled director. The publication of a periodical, such as the present Experiment Station Record, was recommended.



NORMAN J. COLMAN,
Commissioner and Secretary of Agriculture.
1885-1889.

New divisions established.—The Division of Pomology and the Division of Ornithology and Mammalogy were established under Commissioner Colman. The latter was in response to a demand for an investigation of the damage done to crops and fruits by birds, especially the English sparrow and bobolink, or rice bird.

The section of vegetable pathology was formed in the Division of Botany. A station was established at Aurora, Ill., for the study of apiculture. The irrigation inquiries were continued and a report was made on what had already been done. The study of public highways was begun.

The question of reeling silk from the cocoons at a cost sufficiently low to permit competition with cheap foreign labor was taken up, and reeling rooms were established at New Orleans, La., Philadelphia, Pa.,

and Piedmont, Cal. These were discontinued after a year, and the work was carried on at Washington, D. C.

Commissioner Colman, in his reports, suggested the commercial cultivation of medicinal and similar plants, naming rhubarb, licorice, arnica, belladonna, digitalis, poppy, ginger, cinchona, vanilla, jalap, and sarsaparilla. He called attention to the possibilities of agriculture in Alaska, the rapid inroad upon the forests for supplying railroad ties, and the planting of trees in the plains.

Scientific discoveries.—The sale of counterfeit butter was arousing the interest of farmers, and prosecutions under the law forbidding it were in progress. Dr. Taylor, the Department microscopist, reported the discovery of characteristic differences between the crystals of lard, beef fat, and butter, as seen under the glass. This discovery was recognized in a report of the American Association of Microscopists as a valuable factor in the determination of the genuineness of butter offered for sale. The application of scientific methods to sugar making was successfully carried out, the diffusion process was tried in making sugar from cane, and a resultant increase in the yield of 40 pounds of sugar to the ton of cane was reported.

War on contagious diseases.—The Bureau of Animal Industry lacked State cooperation in exterminating contagious diseases, because the whole burden of destroying infected animals was thrown upon the State. In 1887 legislation was secured remedying this defect in the law and appropriating \$500,000 for the Bureau, with a provision that any part of the money might be used to pay for animals it was found necessary to kill. Good progress was at once made in stamping out pleuropneumonia. Within the first year 35,451 herds, over 300,000 head, were inspected, and 8,139 animals were slaughtered and paid for. The total expenditures of the Bureau for 1888 were \$499,975.32, against \$99,985.56 in 1887.

THE DEPARTMENT RAISED TO THE FIRST RANK.

On February 9, 1888, the Department was raised to the first rank in the executive branch of the Government. This was largely due to the efforts of the National Grange, an organization founded in 1868 by gentlemen connected with or specially interested in the Department.

At the meeting of the National Grange in Chicago, in 1876, resolutions were passed asking the recognition of the work as of equal importance with any branch of the service. In part these resolutions were as follows:

Whereas the agricultural masses compose one-half of the population of the free States of America upon whom ultimately rest the taxes which sustain the Government. * * *

Resolved, That American agriculturists demand that they shall be recognized as a real factor in the Government by the establishment of a bureau of agriculture, to be presided over by a Cabinet officer, who shall organize the same upon a plan to be devised by the wisdom of Congress, which shall embrace to the fullest the agricultural interests of 20,000,000 of people. * * *

The resolutions were passed on November 25 when the result of the Presidential election of that year was still in doubt. All members of the organization pledged themselves in support of the movement, irrespective of political affiliations.

The work of the Department was at this time treated slightly by many Congressmen, and was considered merely as a means to reach many constituents with small favors by the distribution of seeds and books. The clerkships and other positions in the Department were regarded as patronage to be given to political adherents, with little regard for fitness. So notorious was this condition that the Grange leaders at one time seriously discussed the propriety of asking that the Department be abolished entirely.

But Commissioner Le Duc, when appointed by President Hayes, took up the duties with such earnestness and vigor that the Grange rallied to his support. Congressmen were impressed with the seriousness of the work for which the Commissioner asked appropriations, and at the close of his term the supply of money was made more liberal.

The demand that the head of the Department be given a place at the President's council table was pressed persistently by the National Grange, and was finally taken up by the Farmers' Congress and other influential bodies and by so many persons interested in public affairs that public opinion became fixed in favor of the change, and it was made.

The office of Commissioner having been abolished, Mr. Colman was appointed Secretary, and held the position a little less than a month.

SECRETARY RUSK'S ADMINISTRATION.

Hon. Jeremiah M. Rusk was selected by President Harrison as his Secretary of Agriculture and took control on March 7, 1889. The sketch of his life in the Congressional Directory of that year says: "General Rusk was born in Morgan County, Ohio, in 1830. He was educated in the common schools of the neighborhood, which he attended winters working on the farm in summer. He continued to reside on the farm until his removal to Wisconsin in 1853, since which time—with the exception of a short time—he has been engaged in farming. He held several county offices in Wisconsin; was a member of the legislature of that State in 1862; was commissioned major of the Twenty-fifth Wisconsin Volunteer Infantry in July, 1862, and was soon after promoted to the colonelcy. He served with General Sherman from the siege of Vicksburg till mustered out at the close of the war, and was brevetted brigadier-general for bravery at the battle of Salkehatchie. He was elected bank comptroller of the State of Wisconsin in the year 1866, and reelected in 1868; was elected to the Forty-second, Forty-third, and Forty-fourth Congresses, and was chairman of the Committee on Invalid Pensions in the Forty-third Congress. He was a member of the Republican Congressional Committee for several years, and was

a delegate to the National Republican Convention in 1880. He was appointed by President Garfield and confirmed by the Senate as minister to Paraguay and Uruguay, which appointment he declined, and was also tendered by President Garfield a mission to Denmark and the position of Chief of the Bureau of Printing and Engraving, both of which he declined. He was elected governor of Wisconsin in 1881, reelected in 1884, and reelected for a third term in 1886. He was appointed Secretary of Agriculture on March 4, 1889."

In reorganizing the Department Secretary Rusk divided the work into two main classes: Executive, under the immediate charge of the Secretary; and scientific, under the Assistant Secretary, Hon. Edwin Willits, that office having been just then created.

First of the Farmers' Bulletins.—Mr. Rusk urged the necessity of placing the information gathered by the Department more generally in the

possession of farmers and established the Division of Records and Editing, now the Division of Publications, under Mr. George William Hill, its present chief, to edit and supervise publications and administer the printing fund. He recommended the publication of the Farmers' Bulletins, which have since become so popular. The work to be done in these he summarized as follows: Frequent publication of the results of scientific work and the circulation of the information among practical farmers, insuring its direct application to actual farming operations. He insisted that the language em-



JEREMIAH M. RUSK,
Secretary of Agriculture.
1889-1893.

employed in the bulletins should be intelligible to farmers generally. In addition he planned the publication by press associations, newspapers, and agricultural periodicals of advance reports of the important conclusions reached by experiment and research. In this way he believed the great majority of the farmers of the country would be promptly reached. The demand for Farmers' Bulletins grew rapidly from the start. Several have run over 100,000 in their distribution, and some have exceeded 200,000.

Investigation of foreign markets.—Mr. Rusk began the systematic investigation of foreign markets for American products, procured a special appropriation for the purpose, and for some years a special agent was maintained in Europe. This gentleman, Col. Charles J. Murphy, gave particular attention to the introduction of corn meal for bread among the people of Europe and in the armies of the Continent.

Pleuro-pneumonia eradicated.—The Bureau of Animal Industry grew steadily. Complaints were made by foreign Governments that American meats came very frequently from diseased animals. Restrictions were put upon their importation and in some cases absolute prohibition was enforced. The meat was generally subjected to Government inspection on its arrival in Europe, and as there was no inspection on this side no reply could be made to assertions that it was diseased. Secretary Rusk obtained authority to make inspections and money to pay for them. Soon after this system of inspection was fully in operation the prohibition against American pork in Germany was withdrawn. The number of animals inspected in 1892 was 5,076,929. The total expenses of the bureau were increased from \$469,113.35 to \$649,980.91. The bureau was reorganized at this time and its work assigned to subdivisions as follows: Animal pathology, field investigations and miscellaneous work, and quarantine. The fight against infectious diseases was energetically pushed and on September 26, 1892, Secretary Rusk announced that the country was entirely free from contagious pleuro-pneumonia.

Inspection of American cattle in England.—In 1890 inspection of American cattle by American inspectors stationed in Great Britain was inaugurated. This was necessary in order to check reports of disease in cattle arriving in that country from the United States. With the aid of Minister Robert Lincoln arrangements were made to have all cases of disease examined by American as well as English veterinarians. This led to animated discussions between the two sets of inspectors as to the nature of the malady discovered. Many cases reported by the English officials as pleuro-pneumonia were shown by the American inspectors to be only broncho-pneumonia, a noncontagious form of lung disease. In every case, moreover, by a system of tagging the cattle for identification, it was shown that the cattle so condemned had never been exposed. The condemnations soon ceased.

Improvement in transportation of cattle by sea.—In 1891 Mr. Plimsoll, whose work for the English sailor had established his reputation as a philanthropist, came to this country to lecture against the inhumanities attending the transportation of American cattle to England. That such inhumanities existed was notorious, and Mr. Plimsoll's crusade was greatly encouraged from selfish and interested motives by British stockmen who believed that the effect of the agitation would be unfavorable for the marketing of American cattle. A bill was quickly drawn at the Department after a consultation between members of Congress interested and the Department authorities. This was pushed through at the close of the session and approved on March 3, 1891. It placed the supervision of the cattle quarters of all vessels engaged in the trade under the control of the Secretary of Agriculture. So effectual did this legislation seem to be that Mr. Plimsoll was satisfied and gave up his self-imposed mission. The results have been found so satisfactory that insurance rates on cattle have been reduced from \$8 to \$1 per

head. Basing the calculation upon average annual shipments this represents a saving every year equal to three times the cost of the Bureau of Animal Industry and almost equal to the annual expenses of the entire Department.

Texas fever.—Texas fever among cattle was got under control. The disease had occasioned heavy losses and had baffled all efforts at prevention except by strict quarantine against Texas cattle at certain seasons and under certain conditions. Its appearance was attended with considerable mystery. Stockmen and veterinarians alike had been watching it closely for more than twenty years, and all were puzzled by some of the facts observed. The solution of the most important question in the connection is told in the report of the Bureau of Animal Industry for 1890, as follows:

It has long been suspected by cattle owners that the appearance of the disease in Northern cattle was in some way connected with the ticks distributed by Southern cattle. This hypothesis has, however, been generally discredited by scientific men, and indeed the evidence in favor of it was very slight and intangible. It seemed, however, worthy of investigation, and the result has been to obtain indisputable evidence that the disease is produced by ticks from Southern cattle.

Ticks taken from Southern animals and placed upon pastures which could have been infected in no other way so infected these grounds that susceptible cattle placed upon them contracted the disease in the same length of time and were as seriously affected as were other susceptible cattle placed upon pastures in company with Southern cattle. Again, young ticks that were hatched from the eggs of large ticks picked from Southern cattle were placed upon susceptible animals and produced the disease.

Establishment of the Weather Bureau.—The Weather Bureau was established as a part of the Department service in 1891 by transfer of the work from the War Department. Prof. Mark W. Harrington was appointed chief and organized the new branch in its present quarters at Twenty-fourth and M streets NW., Washington, D. C. The necessary substations of the War Department Signal Service throughout the country were turned over to him. Six hundred new stations were added within a short time, bringing the total up to 1,200, and in three months the volunteer observers had increased to 2,200. Plans were made and put in execution as rapidly as possible for increasing the usefulness of the Bureau to commerce and agriculture by extending the system of frost and storm signals and otherwise reaching all classes of the people. Local forecast officials were appointed in more than twenty cities and they were directed to give out warnings for their localities based on their information as related to local conditions. The cost of the service for the first year was \$861,840.83.

Experiments and Improvements.—In the Fifty-first Congress \$70,000 was appropriated for irrigation experiments in the region from Dakota to Texas along the eastern base of the Rocky Mountains. Hundreds of artesian wells were sunk, and the problem of the use of the underflow was considered, though not investigated, and a report on the whole subject was made in 1892.

Experiments in sugar production were continued by the distribution of 15,000 packages of sugar-beet seed to 8,000 farmers and by the examination of varieties of sorghum with a view to securing that which would yield the largest amount of sugar. The experiments with beets were not successful chiefly because of a lack of care by farmers in cultivation and in taking samples for analysis.

The importation of parasite enemies of scale insects was begun, and the citrus-fruit groves of California were saved from threatened destruction by the scale pests through the successful introduction of the lady-bird (*Tedalia cardinalis*). An effort was also made to introduce parasites for the destruction of the Hessian fly.

Experiments in rain making by use of explosives in the arid regions were made under a special appropriation by Congress, but were unsuccessful.

The investigation of silk reeling was continued for a time, but in 1891 the experiments were discontinued. The industry was found hopeless except with constant aid. The destruction of live-forever as a troublesome weed in some of the Eastern States was accomplished by means of a parasitic fungus. Valuable botanical investigations were made, and 12,000 specimens were added to the herbarium.

SECRETARY MORTON'S ADMINISTRATION.

Hon. J. Sterling Morton became Secretary of Agriculture on March 7, 1893. The Congressional Directory issued soon after says:

"Julius Sterling Morton, of Nebraska City, Nebr., Secretary of Agriculture, was born April 27, 1832, in Jefferson County, N. Y.; is of Scotch-English origin, his ancestors coming to this country in the first vessel after the *Mayflower*, one of them, Nathaniel, being secretary of the colony; removed with his parents when 2 years of age to Michigan; was educated in the public schools of Albion, the State University at Ann Arbor, and Union College, from which latter institution he was graduated; was connected editorially with the Detroit Free Press and Chicago Times; located in Nebraska November 10, 1854, at Bellevue, and April 12 of the following year issued the first number of the Nebraska City News; was elected to the Territorial legislature and reelected in 1857; was appointed secretary to fill the vacancy caused by the death of Governor Thomas B. Cuming in 1858 and served till May, 1861; in 1860 was nominated for Congress and was given the certificate of election, but was unseated by contest; in 1866 was nominated for governor and was defeated by 145 votes, and has been the nominee of his party for that office three times since; has been the favorite candidate of his party several times for United States Senator; is a practical agriculturist and horticulturist, and has contributed largely to the best literature on those subjects; is the author of the Arbor Day legislation, which provides that one day in each year be made a public holiday and be devoted to tree planting, and

which has been adopted in forty-two States; was appointed Secretary of Agriculture by President Cleveland and confirmed March 6, and entered upon his duties March 7, 1893."

Development and reorganization of work.—The Secretary called attention in his first report to the need of a closer supervision of the State experiment stations and better control of the Federal money appropriated for them. In response a law was passed directing an inspection of the stations and their accounts of the use of Government money. This was welcomed by most of the station authorities and was accomplished with good results. The law gave the Secretary power to prescribe the form of annual statements and directed him to ascertain whether expenditures conformed to the requirements of the law of 1887.

Secretary Morton reorganized the Division of Illustrations as a section of the Division of Records and Editing. Subsequently the latter

became the Division of Publications, and the document and folding room was also reorganized and made a section of this division. During this administration, also, the first special appropriation was made for the printing and distribution of Farmers' Bulletins, with a provision that two-thirds of the total number of these bulletins printed are to be distributed by Members of Congress. The number of publications issued, which had increased 300 per cent during Secretary Rusk's administration, again increased over 200 per cent



J. STERLING MORTON,
Secretary of Agriculture.
1893-1897.

under Mr. Morton, while the increase in the aggregate number of copies printed was still greater. Considerable attention was given to enlarging the Department library, and the suggestion was made by Secretary Morton that the Librarian of Congress should transfer to the Department library one of the duplicate volumes furnished him under the copyright law whenever on agricultural subjects.

The Division of Statistics was organized into three sections, as follows: Compilation and foreign statistics; answers to Congressional inquiries and verification of agricultural statistics; records, files, and comparison of crop reports.

The Division of Agrostology was formed, and consular agents throughout the world were requested to send to the Department seeds of new forage plants whenever found. The Handbook of Grasses of the United States was its first important publication.

The Division of Soils was formed as part of the Weather Bureau.

The special need for it was in the demand for information in regard to the relation of soils to meteorological conditions. The Office of Road Inquiry was also established at this time in answer to a general demand for the study of public roads and their improvement. The development of the use of the bicycle contributed notably to this demand. The Division of Microscopy was abolished and its work distributed to the other divisions. A Dairy Division in the Bureau of Animal Industry was established on July 1, 1895, with H. E. Alvord as chief.

The special agents in Europe employed under the special appropriation for extending the demand in foreign markets for agricultural products of the United States were withdrawn, and a new departure made by the organization of a special section under the Secretary's personal direction for the collection and diffusion of information in regard to the requirements and productions of foreign countries.

The irrigation inquiries were brought to a close and the office discontinued.

Columbian Exposition—Discoveries and advances.—The Columbian Exposition came just at the beginning of this administration. The preparation of the Department exhibit had been placed in the hands of Assistant Secretary Willits under Secretary Rusk, and he was subsequently appointed by President Harrison chairman of the Government Board. He was continued in charge till the Exposition closed and the work was wound up. Of the total expenditures by the National Government for representation at this Exposition the Department's share, as reported by Mr. Willits, was \$131,707.71.

The Bureau of Animal Industry devoted considerable time to the study of Texas fever, sheep scab, and tuberculosis; the protection of human life from the dangers of tuberculous diseases was undertaken actively. Inspections of beef and milk were made for this purpose, and directions for the sterilization of milk were sent out for general information. It was at this time decided that inspectors in the Bureau service must pass a civil-service examination, and must be veterinary graduates.

The Weather Bureau made arrangements with the Mexican Government Observatory for exchange of data, and also established a cyclone service in the West Indies. The period covered by forecasts was considerably extended and large additions were made to the number and efficiency of weather observers.

Under the special appropriation for the purpose, nutrition investigations were undertaken in connection with the Office of Experiment Stations and under the direct supervision of W. O. Atwater.

Incidentally to these investigations large profits were disclosed in the baking and supply of bread. It was shown that while flour had fallen much in price bread had not changed, and for a time in many cities a reduction was secured in the price of the loaf.

A valuable discovery was made in the Forestry Division; viz, that

boxing the pine tree for turpentine does not injure the lumber. The knowledge of this fact is estimated to be worth \$2,000,000 to the timber interests. During the course of the timber-test work, the longleaf pine was found to be much stronger than had been previously supposed.

Civil service and savings.—Secretary Morton greatly encouraged the extension of civil-service regulations throughout the Department, and in two notable cases adopted the method of competitive examinations to fill important places which were expressly excepted. The number of persons in the classified service increased notably under him.

In his last report Secretary Morton makes the following summary showing the amounts saved by him from the appropriation bills:

“Thus there will have been covered back into the Treasury since March 7, 1893, two million sixty-six thousand six hundred and sixty-one dollars and nineteen cents (\$2,066,661.19) out of a total amount of eleven million one hundred and seventy-nine thousand four hundred and fifty-five dollars and forty-five cents (\$11,179,455.45) on hand and appropriated.”

Mr. Morton strongly recommended that the amount so saved be applied to the erection of a new and suitable building.

Secretary Morton was strongly opposed to the distribution of seeds, and recommended that the practice be abandoned. He succeeded in changing the method of distribution, so that the packages were no longer sent out from Washington by a force of Department employees, but from the warerooms of the seedsmen holding the contracts.

COMMENCEMENT OF SECRETARY WILSON'S ADMINISTRATION.

Hon. James Wilson, of Iowa, became Secretary on March 7, 1897, by appointment from President McKinley.

THE DEPARTMENT BUILDINGS AND GROUNDS.

With the establishment of a new department of Government in 1862 it was expected that separate offices would be provided, but this was not done till six years later. Reservation 2, at Washington, D. C., a square of ground between Twelfth and Fourteenth streets SW., B street S. and the canal, containing about 40 acres, was given to Commissioner Newton as an experimental farm. The ground was broken in the first year. A supply of water was carried from the city waterworks, and considerable planting of an experimental kind was done.

The main Department building.—In 1867 Congress appropriated \$100,000 for the erection on the reservation of an office building for the Department. The contract was let to Francis Gibbons, jr., of Baltimore, and on September 1, 1868, the house was ready for occupancy. About the same time houses for use in the propagation of plants for distribution were erected, along with conservatories, and a grapery for tests of foreign grapes. The total cost of these buildings was \$140,000. The frontispiece of this bulletin shows the main edifice.

Afterwards some additions were made, but nothing considerable was

done till after the Atlanta Exposition in 1880. The Centennial Exposition at Philadelphia added a large amount of material to the Department museum, but it was thought sufficient to provide space for this by putting up a gallery around the large room on the second floor of the main building. This was then occupied by the museum, as it is now by the library. But after the Atlanta Exposition other additions to the museum were made, and it was then found necessary to have more room. Accordingly \$10,000 was appropriated in 1881 for the construction of a building for its use. The bill called it a "building for display of agricultural implements." It was intended by Commissioner Le Duc that this should be of brick, and it was to be located some distance north of the southeast corner of the reservation. Excavations for the foundation were dug on this proposed site, but Mr. Le Duc was succeeded by Commissioner Loring and the plans were changed. The extreme southeast corner of the grounds was chosen, and the frame structure now used as a museum and for offices for several divisions of the Department was erected.

Erection of smaller structures.—Immediately after this an appropriation of \$25,000 for a building for the storage and distribution of seeds was made, and the brick structure just southeast of the main building was put up. It was occupied by the Seed Division on the first floor and the Division of Statistics on the second; but when, under Secretary Morton, the distribution of seed was taken away from Washington, the lower story of the building was given to the Divisions of Entomology and Biological Survey. In 1879 an appropriation of \$1,500 was made for the building of the stable and in 1883, \$2,500 for an additional greenhouse. In 1897 provision was made for the erection of a fire-proof building at a cost not to exceed \$3,000. This was put up near the south entrance to the grounds at a cost of \$1,650.66. It furnishes safe storage for important books and records. The majority of the other structures on the ground were built by the carpenter, Mr. Halley, from the Department contingent fund. In all not more than \$210,000 appears to have been expended for the Department buildings.

When the main building was erected there were four divisions of the Department work, employing, all told, 50 persons. There are now employed at and near this original structure about 550 persons. They are accommodated, as far as possible, in the Government buildings, but for those that are crowded out, private houses are rented in the residence portion of the city adjacent, at an annual cost of \$4,020. This represents at least \$80,000, which might be economically applied to a new building.

Weather Bureau—Department grounds.—The buildings for the Weather Bureau at Twenty-fourth and M streets NW. were purchased, along with the site, in 1891 for \$112,000. Additions were made to adapt the place for its use at a cost of \$38,000. The grounds contain 54,000 square feet.

The reservation at Twelfth and B streets SW. continued to be used as an experimental garden till after the erection of the Department buildings. It was then agreed that for anything in the way of an experimental farm a much larger tract ought to be provided, and that Mr. Saunders, the Department horticulturist, should be directed to lay out and improve the grounds as an arboretum, to contain all the trees and shrubs which will grow without protection in this climate. They were to be grouped according to their families. The old canal was still in existence in front of the grounds and had to be filled. At the same time Mr. Saunders was converting the swampy reaches of the reservation into the present handsomely rolling grounds, covered with fine trees and surmounted at the front of the building by a terrace, with a beautiful display of flowers. The work of filling the canal and laying out and beautifying the grounds was completed in 1871.

COST OF THE DEPARTMENT; ITS VALUE TO THE COUNTRY.

The Department of Agriculture up to July 1, 1897, has cost the people of the United States, all told, \$26,915,988. This is much less than \$500,000 a year. The question naturally presents itself: In what manner and to what extent has it made a return for this outlay? For in this respect does the Department of Agriculture differ from all the other departments of the Government; namely, that its services are more susceptible of being measured in actual money value. Its duties are not confined to the collection of taxes nor to police protection; it spreads information by which the people are better able to pay taxes and to protect their property and increase its value. About the time the work of the Department began it was necessary to import considerable quantities of agricultural products. This was partly due to bad crop seasons, but partly also to careless and ignorant methods of culture. Fertilizers were little known, barnyard manure was still regarded in many places as a nuisance to be got rid of, and rotation of crops was little practiced. Planting according to the phases of the moon was still in vogue.

Increase in cereals.—The production of corn and wheat, shown by the census, affords some proof of the increasing effectiveness of cultivation and, by just inference, of the assistance given by the Department. In 1839 the production of corn was 23 bushels for each person in the United States; in 1859 it was 27 bushels; in 1889, 34 bushels. This does not of course show with certainty that there was a corresponding increase in the production for each acre cultivated, but a comparison of the crop of 1879 with that of 1889 justifies that inference. In 1879 there were 35 bushels of corn raised for every person in the country, in 1889 only 34 bushels, but the production per acre increased from 28.1 bushels in 1879 to 29.5 in 1889. It may be supposed that a similar increase in product per acre would be found for the other decades if a record of the acreage planted had been made.

The comparison of the production of wheat gives a similar result. The quantity raised for each person in 1839 was 5.3 bushels; in 1890 it was 7.4.

Other manifest gains.—Through its Division of Statistics the Department seeks to place in the hands of farmers such information as will enable them to estimate wisely the value of their crops and avoid deception and loss from speculative information spread abroad in the interest of buyers. Through the Bureau of Animal Industry it not only seeks to discover the causes and remedies of animal diseases, but also to maintain measures of control and prevention that will hinder the spread of contagion. Further, the diseases of plants are the subject of study of one division, and injurious insects receive the special attention of another. Also, the introduction of new and valuable economic plants has been a most important feature of Department work, and many improved varieties have resulted from its efforts.

Now, while it is manifestly impossible to express the results of all this work exactly in money returns, yet it is quite possible to do so in some cases, and in others to assure ourselves that they are too far-reaching and too great to be easily made the subject of exact reckoning. For instance, no one can venture upon an accurate estimate of the money saved to the country by the suppression and utter eradication of contagious pleuro-pneumonia by the Bureau of Animal Industry, nor of the value of the inspection of animals and meats by which European markets are kept open to these products; yet, as has already been stated, our actual saving, as the result of vessel inspection, is shown very closely by the reduction of the rate of insurance on export animals, which averages in the aggregate over \$2,100,000 yearly. In like manner the money returns of the increased yield of sugar per ton of cane, secured through the Division of Chemistry, can be shown by actual calculation, but no one can estimate the value of the introduction of the beet-sugar industry and its gradual extension until the entire consumption of sugar in this country shall be met by a home supply. Still no one doubts, who knows anything about the subject, that any one of the services mentioned will return to the Government in actual money value many times over what the entire cost of the Department has been. Many instances have been supplied of carefully estimated savings effected by the remedies or prevention secured as a result of investigation by the Department both in the case of injurious insects and of plant diseases, but in the main the gains thus effected are quite beyond calculation.

Who, for instance, can estimate the value of the rescue from annihilation of the California orange industry through the introduction of the Australian parasite of the scale insect which was devastating the citrus orchards in that State? Equally beyond accurate estimate is the value of the introduction of the Bahia or navel orange by the horticulturist of the Department, Mr. William Saunders.

Specific examples of money saved through the warnings of the Weather Bureau are numerous and easily established. In 1894 the Weather Bureau, by its warnings, saved from the rocks, at the entrance of Chesapeake Bay, the ship *Rappahanock*, with a cargo worth over \$600,000. Furthermore, it is estimated that in the fall of that year 2,305 vessels, valued at \$36,283,913, but for the Weather Bureau warnings would have put to sea in approaching storms and heavy losses would have followed.

Frequently throughout the year minor savings, through the services of this Bureau, are reported from all sections of the country, aggregating a sum far in excess of its annual expenditures.

The discovery by the Division of Forestry of the real value of pine-tree timber, after the trees had been boxed for turpentine, has been estimated by reliable authorities as worth not less than \$2,000,000 to the Southern States.

Secretary Rusk's estimate.—Instances of the money value of services actually rendered by the Department might be enumerated indefinitely. Ample and sufficient grounds exist for the confidence that the new work undertaken from year to year will result in valuable returns in the future similar to those instanced. One-tenth has not been told, but enough has been said, without touching at all on the work of many of the divisions of the Department, to justify to the most skeptical the statement of a former Secretary, the Hon. J. M. Rusk, who, in his annual report for 1891, said:

“In concluding the review of the work done under the several divisions of this Department since the date of my last annual report, it gives me pleasure to state, and I say this advisedly, that each one of more than a dozen divisions whose work I have reviewed has returned in actual value to the country during the past year far more than the entire annual appropriation accorded to this Department.”

BUREAUS, DIVISIONS, AND OFFICES.

The bureaus, offices, and divisions of the Department as now organized are as follows:

THE WEATHER BUREAU.

The Weather Bureau had its origin in the publication by the Department, beginning in 1863, of meteorological data gathered by the Smithsonian Institution, and in the recommendation by Commissioner Newton, the first Commissioner of Agriculture, that daily weather reports by telegraph, under the direction of the Government, be distributed to the country. This service was authorized by an act of Congress of February 4, 1870, and was conducted by the Chief Signal Officer of the Army for twenty years. By the act of October 1, 1890, the Weather Bureau as such was officially recognized, and was transferred to the Department of Agriculture, the general details of its organization being defined in that act. On July 1, 1891, the actual transfer took place.

The duties of the Weather Bureau are the forecasting of the weather, issue of storm warnings, display of weather and flood signals for the benefit of agriculture, commerce, and navigation; the gauging and reporting of rivers, the maintenance and operation of seacoast telegraph lines, and the collection and transmission of marine intelligence for the benefit of commerce and navigation; the reporting of temperature and rainfall conditions for the cotton, sugar, rice, and other interests; the display of frost and cold-wave signals; the distribution of meteorological information in the interests of agriculture and commerce, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential to the proper execution of the foregoing duties.

The Bureau now has 150 fully equipped meteorological stations; 253 stations specially equipped for the display of danger warnings to mariners; 261 stations for the taking of telegraphic reports of temperature and rainfall in the growing fields, and over 3,000 stations where voluntary observers make records of temperature and rainfall with standard instruments. Mark W. Harrington was the first chief, and was succeeded on July 1, 1895, by Willis L. Moore, the present chief.

BUREAU OF ANIMAL INDUSTRY.

The Bureau of Animal Industry, established in 1884, now comprises subdivisions as follows: Inspection division, miscellaneous division, pathological division, biochemic division, zoological laboratory, dairy

division, experiment station. Its duties are to make investigations as to the existence of contagious pleuro-pneumonia, and other dangerous communicable diseases of live stock; to make original investigations as to the nature and prevention of such diseases, and to superintend measures for their extirpation; and to report on the condition and means of improving the animal industries of the country. The Bureau also has charge of the inspection of import and export animals, of the inspection of vessels for the transportation of export animals, and of the quarantine stations for imported neat cattle; supervises the interstate movement of cattle; and inspects live stock and their products slaughtered for food consumption. D. E. Salmon has been chief of the Bureau since its organization; appointed May 31, 1884.

DIVISION OF GARDENS AND GROUNDS.

The propagating garden, started in 1858, was turned over by the Commissioner of Patents to the Department of Agriculture shortly after the creation of the Department in May, 1862, and the Division of Gardens and Grounds was organized as an experimental garden by the appointment of Mr. William Saunders, of Pennsylvania, as horticulturist superintendent, in September, 1862. The superintendent is charged with the care of keeping the lawns and other ornamentations of the park, and with all duties connected with the introduction and propagation of desirable economic plants, and their dissemination in suitable climates throughout the States.

William Saunders has been superintendent since the establishment of the division, thirty-six years ago, and is the only person now connected with the Department who was appointed by the first Commissioner. After the reservation now occupied by the Department was secured, he furnished the plans for the laying out of the grounds, and the conservatories and other buildings were erected under his direction. The present superintendent has been from the first intimately connected with the organization of the Department. For over twenty years he served as vegetable physiologist, pomologist, and adviser on all matters relating to soils and soil culture, and farms and gardens and everything pertaining thereto, performing duties on matters which are now conducted by divisions specially formed for the purpose.

DIVISION OF CHEMISTRY.

The Division of Chemistry, established in 1862, makes investigations of the methods proposed for the analysis of soils, fertilizers, and agricultural products and such analyses as pertain in general to the interests of agriculture. It also conducts researches on all subjects in which chemistry and agriculture are conjoined. The study of the composition of human foods and their adulterations is one of the chief functions of this division. It can not undertake the analyses of articles of a miscellaneous nature, but application for such analyses should be made to the directors of agricultural experiment stations of the different States.

The division does not make assays of ores nor analyses of minerals, except when related to general agricultural interests; nor analyses of water. The successive chiefs have been C. M. Wetherill, Henry Erni, Thomas Antisell, R. T. Brown, William McMurtrie, and Peter Collier. The present chief is H. W. Wiley, who was appointed April 9, 1883.

DIVISION OF ENTOMOLOGY.

The Division of Entomology, organized in 1863, conducts investigations concerning injurious and beneficial insects; disseminates information regarding the results of these investigations and the best remedies to be used against injurious insects, by means of correspondence, circulars, bulletins and reports; prepares specimens for illustrative and museum purposes; and in general acts as a bureau of information on all matters relating to economic entomology. The chiefs have been Townend Glover, C. V. Riley, J. H. Comstock, and C. V. Riley. L. O. Howard is the present chief, appointed June 1, 1894.

DIVISION OF STATISTICS.

The Division of Statistics, established in 1863, collects information as to the condition, prospects, and harvests of the principal crops, and of the numbers and status of farm animals through a corps of county correspondents, and with the aid of a supplementary organization under the direction of State agents. It obtains similar information from European countries monthly through the deputy consul-general at London, assisted by consular, agricultural, and commercial authorities. It records and tabulates and coordinates statistics of agricultural production, distribution, and consumption, the authorized data of governments, institutes, societies, boards of trade, and individual experts; and writes, edits, and publishes a monthly bulletin for the use of editors and writers, and for the information of producers and consumers, and for their protection against combination and extortion in the handling of the products of agriculture. Former chiefs have been Lewis Bollman, J. R. Dodge, Charles Worthington, J. R. Dodge (reappointed), and Henry A. Robinson; John Hyde, the present chief, was appointed August 1, 1897.

DIVISION OF BOTANY.

The Division of Botany was established in March, 1869. It maintained the United States National Herbarium until July 1, 1896, when that work was transferred to the Smithsonian Institution. The chief of the division, however, continues to have charge and the specimens are used by his assistants. The division now publishes information of the treatment of weeds, experiments with poisonous and medicinal plants, tests seeds with a view to their increased purity and commercial value, and investigates other questions of economic botany. The chiefs have been C. C. Parry, and George Vasey. The present chief is Frederick V. Coville, appointed March 9, 1893.

DIVISION OF ACCOUNTS AND DISBURSEMENTS.

The Division of Accounts and Disbursements, established July 1, 1880, audits and pays all accounts and adjusts claims against the Department; decides questions involving the expenditure of public funds; prepares advertisements, schedules, contracts for annual supplies, leases and agreements; issues requisitions for the purchase of supplies, requests for passenger and freight transportation; prepares the annual estimates of appropriations, and attends to all other business relating to the financial interests of the Department. B. F. Fuller, deceased, was the first chief. Frank L. Evans, the present chief, was appointed July 13, 1893.

DIVISION OF FORESTRY.

The Division of Forestry, organized by order of the Commissioner in 1881, and reorganized by Congress as a division in 1886, is occupied with experiments, investigations, and reports dealing with the subject of forestry, and with the dissemination of information upon forestry matters. N. H. Egleston was the first chief, followed by B. E. Fernow, the present chief, who was appointed March 15, 1886.

DIVISION OF BIOLOGICAL SURVEY.

The Division of Biological Survey (established as the Division of Ornithology and Mammalogy in 1886) studies the distribution of animals and plants, and maps the natural life zones of the country; it also investigates the economic relations of birds and mammals, and recommends measures for the preservation of beneficial and the destruction of injurious species. C. Hart Merriam has been the only chief—appointed July 1, 1886, as chief of the Division of Ornithology and Mammalogy, and July 1, 1896, as chief of the Biological Survey.

DIVISION OF POMOLOGY.

The Division of Pomology, established in 1886, collects and distributes information in regard to the fruit interests of the United States, investigates the habits and peculiar qualities of fruits, their adaptability to various soils and climates, and conditions of culture, and introduces new and untried fruits from foreign countries. The chiefs have been H. E. Van Deman, S. B. Heiges, with W. A. Taylor, the assistant in charge for seven months. G. B. Brackett, the present chief, was appointed August 1, 1897.

DIVISION OF VEGETABLE PHYSIOLOGY AND PATHOLOGY.

This division was originally established in 1886 as a section of mycology in the Division of Botany under F. Lamson-Scribner; the following year it was changed to a section of vegetable pathology, and in 1891 became a separate division. In 1895 the scope of its work was enlarged and name altered to Division of Vegetable Physiology and Pathology.

The division has for its object a study of normal and abnormal life processes of plants. It seeks by means of both field and laboratory investigations in plant physiology, plant breeding and selection, and the morphology and classification of fungi, to determine the causes and methods of prevention of plant diseases, the amelioration of economic plants, and rational methods of growing commercial crops. B. T. Galloway, the present chief, was appointed chief of the section of vegetable pathology November 1, 1888, and August 8, 1894, was made chief of the division as it now exists.

OFFICE OF EXPERIMENT STATIONS.

The Office of Experiment Stations, established in 1888, represents the Department in its relation to the experiment stations, which are now in operation in all the States and Territories. It seeks to promote the interests of agricultural education and investigations throughout the United States. It collects and disseminates general information regarding the colleges and stations, and publishes accounts of agricultural investigations at home and abroad. It also indicates lines of inquiry, aids in the conduct of cooperative experiments, reports upon the expenditures and work of the stations, and in general furnishes them with such advice and assistance as will best promote the purposes for which they were established. It is also charged with the investigation of the nutritive value and economy of human food. The directors have been W. O. Atwater and A. W. Harris. A. C. True is the present director, appointed September 26, 1893.

OFFICE OF FIBER INVESTIGATIONS.

Fiber investigations were begun in the Division of Statistics in 1889, and in 1890 the Office of Fiber Investigations was established. It collects and disseminates information regarding the cultivation of textile plants, directs experiments in the culture of new and hitherto unused plants, purchases seed and plants for limited distribution for experimental purposes, and investigates the merit of new machines and processes for extracting the fiber and preparing it for manufacture. Chas. Richards Dodge has been special agent from the beginning, and his appointment as special agent in charge of the office dates from January 1, 1891.

DIVISION OF PUBLICATIONS.

The Division of Publications was established in 1889 as a section of the Division of Statistics, which had originally been charged with the work of editing the Department reports. In 1890 it was organized and separately appropriated for as the Division of Records and Editing, becoming the Division of Publications in 1895. This division has entire supervision of the editing, printing, and publishing of the Department, and the distribution of all publications, being especially charged, fur-

thermore, with the preparation, publication, and distribution of Farmers' Bulletins. The division issues advance notices and a monthly list of publications, and prepares for publication any information of special interest to agriculturists. George William Hill was appointed editor July 8, 1889, and has been the chief of the division since its organization; appointed July 14, 1890.

OFFICE OF ROAD INQUIRY.

The Office of Road Inquiry, established in 1893, collects information concerning the system of road management throughout the United States, conducts investigations into methods of road making, directs the building of sample roads at the agricultural colleges and experiment stations, and prepares publications on the subject of roads and road laws. Roy Stone has been at the head of the office since its organization, first as special agent and engineer, and since October 3, 1893, as director.

DIVISION OF AGROSTOLOGY.

The Division of Agrostology, formerly in the Division of Botany, was established as an independent division July 1, 1895, under the present chief F. Lamson-Scribner. It is charged with the investigations of the natural history, geographical distribution, and uses of grasses and forage plants, their adaptation to special soils and climates, the introduction of promising native and foreign kinds into cultivation, and the preparation of publications and correspondence relative to these plants. F. Lamson-Scribner has been in charge of the division since its organization, becoming chief July 1, 1895.

DIVISION OF SOILS.

The Division of Soils (formerly Division of Agricultural Soils in the Weather Bureau) was established as an independent division of the Department in 1894. It has for its object the investigation of the texture and other physical properties of soils and their relation to crop production. Milton Whitney, who has been in charge of the division since its organization, was appointed chief July 1, 1895.

SECTION OF FOREIGN MARKETS.

The Section of Foreign Markets was instituted March 20, 1894, under a clause in the act of appropriations for the Department of Agriculture setting aside \$10,000 for the purpose of making "investigations concerning the feasibility of extending the demands of foreign markets for the agricultural products of the United States." The work of the section consists chiefly in the preparation of bulletins and circulars designed to convey information regarding such opportunities as exist for the extension of our export trade in American farm products.

W. B. Nassau, deceased, was the first chief. The present chief, Frank H. Hitchcock, was appointed January 9, 1897.

LIBRARY.

The library of the Department was first officially recognized by the appointment of J. B. Russell as librarian in 1871. The collection of books had its origin in the transfer in 1869 of the works on agriculture from the library of the Patent Office. Additions have been made from time to time by exchange and purchase. The library now contains 58,000 volumes, and is undoubtedly the best separate collection on agriculture and allied subjects in the United States—probably the best in the world. It comprises complete sets of State agricultural publications and files of many of the agricultural journals from the beginning; a large collection of the official reports on agricultural subjects issued by foreign governments; important collections in botany, horticulture, forestry, zoology, and entomology; numerous sets of scientific serials; a well-selected collection of encyclopedias, atlases, and other general reference works, and a small collection of biography, history, and general literature. A quarterly list of the additions to the library is published, and several lists of books on agricultural subjects have been issued. Succeeding Mr. Russell as librarian, Mrs. Ernestine H. Stevens served from November 1, 1877. The present librarian, William Parker Cutter, was appointed August 28, 1893.

THE MUSEUM.

The museum had its beginning in the old agricultural bureau of the Patent Office, the nucleus of the collection being a large series of fruit models and stuffed birds, the work of Prof. Townend Glover, of that Bureau. When the Department of Agriculture was organized, in 1862, Mr. Glover became its entomologist, and the museum was established under him in 1864 as a recognized institution. From this time forward its collections were steadily increased by donations and purchases, and when the plans were being drawn for a separate building for the Department of Agriculture, the large hall now used for the library was planned, to be devoted to museum purposes. The building was occupied about the beginning of 1868, and the museum moved from the Patent Office. About this time the Glover collection of fruit models, birds, and insects was purchased by a special appropriation of \$10,000, the Government having had the loan of it for over ten years. Professor Glover was assisted in the museum work at the time by the assistant entomologist, Mr. Charles Richards Dodge, who, after 1870, had practical charge of the museum until 1878.

The valuable collections secured from foreign governments at the close of the Centennial Exposition necessitated the erection of galleries on either side of the museum hall, upon which the new material was arranged in 1877. After that year, Professor Glover and Mr. Dodge

having retired from the Department, the museum was placed in charge of Dr. Vasey, the botanist, who remained in charge until it was transferred to the museum building, in the southeast corner of the Agricultural grounds, erected to make room for additions at the close of the first Atlanta Exposition. Subsequent to removal, Prof. Spencer F. Baird, Secretary of the Smithsonian Institution, as the lawful custodian of all Government collections, transferred to the National Museum for safe-keeping some of the more valuable exhibits in its possession. This was under the law which gives the National Museum complete control over all Government museums.

The first curator of the Museum was Robert G. Blaine. His successors have been H. R. Branham, Nathaniel Shatswell, James M. Watt, and Nathaniel Shatswell, reappointed.

LEGISLATION AND EXPENSES.

LAW CREATING THE DEPARTMENT OF AGRICULTURE.

The Department of Agriculture was established by an act of Congress approved by President Lincoln, May 15, 1862. The full text of the act is as follows:

AN ACT to establish a Department of Agriculture.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby established at the seat of the government of the United States a Department of Agriculture, the general designs and duties of which shall be to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word, and to procure, propagate, and distribute among the people new and valuable seeds and plants.

SEC. 2. *And be it further enacted,* That there shall be appointed by the President, by and with the advice and consent of the Senate, a "Commissioner of Agriculture," who shall be the Chief Executive officer of the Department of Agriculture, who shall hold his office by a tenure similar to that of other civil officers appointed by the President, and who shall receive for his compensation a salary of three thousand dollars per annum.

SEC. 3. *And be it further enacted,* That it shall be the duty of the Commissioner of Agriculture to acquire and preserve in his Department all information concerning agriculture which he can obtain by means of books and correspondence and by practical and scientific experiments (accurate records of which experiments shall be kept in his office), by the collection of statistics, and by any other appropriate means within his power; to collect, as he may be able, new and valuable seeds and plants; to test by cultivation the value of such of them as may require such tests; to propagate such as may be worthy of propagation, and to distribute them among agriculturists. He shall annually make a general report in writing of his acts to the President and to Congress, in which he may recommend the publication of papers forming parts of or accompanying his report, which report shall also contain an account of all moneys received and expended by him. He shall also make special reports on particular subjects whenever required to do so by the President or either House of Congress, or when he shall think the subject in his charge requires it. He shall receive and have charge of all the property of the agricultural division of the Patent Office in the Department of the Interior, including the fixtures and property of the propagating garden. He shall direct and superintend the expenditure of all money appropriated by Congress to the Department and render accounts thereof, and also of all money heretofore appropriated for agriculture and remaining unexpended. And said Commissioner may send and receive through the mails, free of charge, all communications and other matter pertaining to the business of his Department, not exceeding in weight 32 ounces.

SEC. 4. *And be it further enacted,* That the Commissioner of Agriculture shall

appoint a chief clerk, with a salary of two thousand dollars, who in all cases during the necessary absence of the Commissioner, or when the said principal office shall become vacant, shall perform the duties of Commissioner, and he shall appoint such other employees as Congress may from time to time provide, with salaries corresponding to the salaries of similar officers in other departments of the Government; and he shall, as Congress may from time to time provide, employ other persons, for such time as their services may be needed, including chemists, botanists, entomologists, and other persons skilled in the natural sciences pertaining to agriculture. And the said Commissioner, and every other person to be appointed in the said Department, shall, before he enters upon the duties of his office or appointment, make oath or affirmation truly and faithfully to execute the trust committed to him. And the said Commissioner and the chief clerk shall also, before entering upon their duties, severally give bonds with sureties to the Treasurer of the United States, the former in the sum of ten thousand dollars and the latter in the sum of five thousand dollars, conditional to render a true and faithful account to him or his successor in office quarter-yearly accounts of all moneys which shall be by them received by virtue of the said office, with sureties to be approved as sufficient by the Solicitor of the Treasury; which bonds shall be filed in the office of the First Comptroller of the Treasury, to be by him put in suit upon any breach of the conditions thereof.

Approved May 15, 1862.

CHANGE IN RANK OF THE DEPARTMENT.

The Department was made an Executive office of the first rank under the law approved by President Cleveland February 9, 1889. By that act the title of the head of the Department was changed from Commissioner to Secretary, and he became a member of the President's Cabinet.

AN ACT to enlarge the powers and duties of the Department of Agriculture and to create an Executive Department to be known as the Department of Agriculture.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Department of Agriculture be an Executive Department under the supervision and control of the Secretary of Agriculture, who shall be appointed by the President, by and with the advice and consent of the Senate; and section one hundred and fifty-eight of the Revised Statutes is hereby amended to include such Department, and the provisions of title four of the Revised Statutes, including all amendments thereto, are hereby made applicable to said Department.

SEC. 2. That there shall be in said Department an Assistant Secretary of Agriculture, to be appointed by the President, by and with the advice and consent of the Senate, who shall perform such duties as may be required by law or prescribed by the Secretary.

SEC. 3. That the Secretary of Agriculture shall receive the same salary as is paid to the Secretary of each of the Executive Departments and the salary of the Assistant Secretary of Agriculture shall be the same as that now paid to the First Assistant Secretary of the Department of the Interior.

SEC. 4. That all laws and parts of laws relating to the Department of Agriculture now in existence, as far as the same are applicable and not in conflict with this act, and only so far, are continued in full force and effect.

Approved, February 9, 1889.

Several other changes have been made in the law, including an amendment which repeals the requirement that the Commissioner (Secretary) and chief clerk give bond. Neither is now charged with any government property or money.

LAW CREATING THE BUREAU OF ANIMAL INDUSTRY.

The Bureau of Animal Industry was established as an integral branch of Department activity by a law approved on May 29, 1884. The text of that law is as follows:

AN ACT for the establishment of a Bureau of Animal Industry, to prevent the exportation of diseased cattle, and to provide means for the suppression and extirpation of pleuro-pneumonia and other contagious diseases among domestic animals.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Commissioner of Agriculture shall organize in his department a Bureau of Animal Industry, and shall appoint a chief thereof, who shall be a competent veterinary surgeon, and whose duty it shall be to investigate and report upon the condition of the domestic animals of the United States, their protection and use, and also inquire into and report the causes of contagious, infectious, and communicable diseases among them, and the means for the prevention and cure of the same, and to collect such information on these subjects as shall be valuable to the agricultural and commercial interests of the country; and the Commissioner of Agriculture is hereby authorized to employ a force sufficient for this purpose, not to exceed twenty persons at any one time. The salary of the chief of said bureau shall be three thousand dollars per annum; and the Commissioner shall appoint a clerk for said bureau, with a salary of one thousand five hundred dollars per annum.

SEC. 2. That the Commissioner of Agriculture is authorized to appoint two competent agents, who shall be practical stock raisers or experienced business men familiar with questions pertaining to commercial transactions in live stock, whose duty it shall be, under the instructions of the Commissioner of Agriculture, to examine and report upon the best methods of treating, transporting, and caring for animals, and the means to be adopted for the suppression and extirpation of contagious pleuro-pneumonia, and to provide against the spread of other dangerous contagious, infectious, and communicable diseases. The compensation of said agents shall be at the rate of ten dollars per diem, with all necessary expenses, while engaged in the actual performance of their duties under this act when absent from their usual place of business or residence as such agent.

SEC. 3. That it shall be the duty of the Commissioner of Agriculture to prepare such rules and regulations as he may deem necessary for the speedy and effectual suppression and extirpation of said diseases, and to certify such rules and regulations to the executive authority of each State and Territory, and invite said authorities to cooperate in the execution and enforcement of this act. Whenever the plans and methods of the Commissioner of Agriculture shall be accepted by any State or Territory in which pleuro-pneumonia or other contagious, infectious, or communicable disease is declared to exist, or such State or Territory shall have adopted plans and methods for the suppression and extirpation of said diseases, and such plans and methods shall be accepted by the Commissioner of Agriculture, and whenever the governor of a State or other properly constituted authorities signify their readiness to cooperate for the extinction of any contagious, infectious, or communicable disease in conformity with the provisions of this act, the Commissioner of Agriculture is hereby authorized to expend so much of the money appropriated by this act as may be necessary in such investigations, and in such disinfection and quarantine measures as may be necessary to prevent the spread of the disease from one State or Territory into another.

SEC. 4. That in order to promote the exportation of live stock from the United States the Commissioner of Agriculture shall make special investigation as to the existence of pleuro-pneumonia, or any contagious, infectious, or communicable disease, along the dividing lines between the United States and foreign countries, and along the lines of transportation from all parts of the United States to ports from

which live stock are exported, and make report of the results of such investigation to the Secretary of the Treasury, who shall, from time to time, establish such regulations concerning the exportation and transportation of live stock as the results of said investigations may require.

SEC. 5. That to prevent the exportation from any port of the United States to any port in a foreign country, of live stock affected with any contagious, infectious, or communicable disease, and especially pleuro-pneumonia, the Secretary of the Treasury be, and he is hereby, authorized, to take such steps and adopt such measures not inconsistent with the provisions of this act, as he may deem necessary.

SEC. 6. That no railroad company within the United States, or the owners or masters of any steam or sailing or other vessel or boat, shall receive for transportation or transport, from one State or Territory to another, or from any State into the District of Columbia, or from the District into any State, any live stock affected with any contagious, infectious, or communicable disease, and especially the disease known as pleuro-pneumonia; nor shall any person, company, or corporation deliver for transportation to any railroad company, or master or owner of any boat or vessel, any live stock, knowing them to be affected with any contagious, infectious, or communicable disease; nor shall any person, company, or corporation drive on foot or transport in private conveyance from one State or Territory to another, or from any State into the District of Columbia, or from the District into any State, any live stock, knowing them to be affected with any contagious, infectious, or communicable disease, and especially the disease known as pleuro-pneumonia: *Provided*, That the so-called splenic or Texas fever shall not be considered a contagious, infectious, or communicable disease within the meaning of sections four, five, six and seven of this act, as to cattle being transported by rail to market for slaughter, when the same are unloaded only to be fed and watered in lots on the way thereto.

SEC. 7. That it shall be the duty of the Commissioner of Agriculture to notify, in writing, the proper officials or agents of any railroad, steamboat, or other transportation company doing business in or through any infected locality, and by publication in such newspapers as he may select, of the existence of said contagion; and any person or persons operating any such railroad, or master or owner of any boat or vessel, or owner or custodian of or person having control over such cattle or other live stock within such infected district, who shall knowingly violate the provisions of section six of this act, shall be guilty of a misdemeanor, and, upon conviction, shall be punished by a fine of not less than one hundred nor more than five thousand dollars, or by imprisonment for not more than one year, or by both such fine and imprisonment.

SEC. 8. That whenever any contagious, infectious, or communicable disease affecting domestic animals, and especially the disease known as pleuro-pneumonia, shall be brought into or shall break out in the District of Columbia, it shall be the duty of the Commissioners of said District to take measures to suppress the same promptly and to prevent the same from spreading; and for this purpose the said Commissioners are hereby empowered to order and require that any premises, farm, or farms where such disease exists, or has existed, be put in quarantine; to order all or any animals coming into the District to be detained at any place or places for the purpose of inspection and examination; to prescribe regulations for and to require the destruction of animals affected with contagious, infectious, or communicable disease, and for the proper disposition of their hides and carcasses; to prescribe regulations for disinfection, and such other regulations as they may deem necessary to prevent infection or contagion being communicated, and shall report to the Commissioner of Agriculture whatever they may do in pursuance of the provisions of this section.

SEC. 9. That it shall be the duty of the several United States district attorneys to prosecute all violations of this act which shall be brought to their notice or knowledge by any person making the complaint under oath; and the same shall be heard

before any district or circuit court of the United States or Territorial court holden within the district in which the violation of this act has been committed.

SEC. 10. That the sum of one hundred and fifty thousand dollars, to be immediately available, or so much thereof as may be necessary, is hereby appropriated, out of any moneys in the Treasury not otherwise appropriated, to carry into effect the provisions of this act.

SEC. 11. That the Commissioner of Agriculture shall report annually to Congress, at the commencement of each session, a list of the names of all persons employed, an itemized statement of all expenditures under this act, and full particulars of the means adopted and carried into effect for the suppression of contagious, infectious, or communicable diseases among domestic animals.

Approved, May 29, 1884.

TRANSFER OF WEATHER BUREAU TO THE DEPARTMENT.

The Weather Bureau was transferred from the War Department to the Department of Agriculture under a law approved October 1, 1890. The principal sections of this law are given here.

AN ACT to increase the efficiency and reduce the expenses of the Signal Corps of the Army, and to transfer the weather service to the Department of Agriculture.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the civilian duties now performed by the Signal Corps of the Army shall hereafter devolve upon a bureau to be known as the Weather Bureau, which, on and after July first, eighteen hundred and ninety-one, shall be established in and attached to the Department of Agriculture, and the Signal Corps of the Army shall remain a part of the military establishment under the direction of the Secretary of War, and all estimates for its support shall be included with other estimates for the support of the military establishment.

* * * * *

SEC. 3. That the Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, on and after July first, eighteen hundred and ninety-one, shall have charge of the forecasting of weather, the issue of storm warnings, the display of weather and flood signals for the benefit of agriculture, commerce, and navigation, the gauging and reporting of rivers, the maintenance and operation of sea-coast telegraph lines and the collection and transmission of marine intelligence for the benefit of commerce and navigation, the reporting of temperature and rain-fall conditions for the cotton interests, the display of frost and cold-wave signals, the distribution of meteorological information in the interests of agriculture and commerce, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential for the proper execution of the foregoing duties.

SEC. 4. That the Weather Bureau shall hereafter consist of one Chief of Weather Bureau and such civilian employees as Congress may annually provide for and as may be necessary to properly perform the duties devolving on said bureau by law, and the chief of said bureau shall receive an annual compensation of four thousand five hundred dollars, and be appointed by the President, by and with the advice and consent of the Senate: *Provided*, That the Chief Signal Officer of the Army may, in the discretion of the President, be detailed to take charge of said bureau, and in like manner other officers of the Army, not exceeding four, expert in the duties of the weather service, may be assigned to duty with the Weather Bureau, and while so serving shall receive the pay and allowances to which they are entitled by law.

SEC. 5. That the enlisted force of the Signal Corps, excepting those hereinafter provided for, shall be honorably discharged from the Army on June thirtieth, eighteen hundred and ninety-one, and such portion of this entire force, including the civilian

employees of the Signal Service, as may be necessary for the proper performance of the duties of the Weather Bureau, shall, if they so elect, be transferred to the Department of Agriculture, and the compensation of the force so transferred shall continue as it shall be in the Signal Service on June thirtieth, eighteen hundred and ninety-one, until otherwise provided by law: *Provided*, That skilled observers serving in the Signal Service at said date shall be entitled to preference over other persons not in the Signal Service for appointment in the Weather Bureau to places for which they may be properly qualified until the expiration of the time for which they last enlisted.

SEC. 9. That on and after July first, eighteen hundred and ninety-one, the appropriations for the support of the Signal Corps of the Army shall be made with those of other staff corps of the Army, and the appropriations for the support of the Weather Bureau shall be made with those of the other bureaus of the Department of Agriculture, and it shall be the duty of the Secretary of Agriculture to prepare future estimates for the Weather Bureau which shall be hereafter specially developed and extended in the interests of agriculture.

 Approved October 1, 1890.



SENATOR JUSTIN S. MORRILL.
(Father of the Agricultural and Mechanical Colleges.)



HON. WILLIAM H. HATCH.
(Father of Agricultural Experiment Stations Died December 24, 1896.)

LANDS FOR AGRICULTURAL COLLEGES.

The day following the establishment of the Department the law granting public lands for the establishment of agricultural colleges was approved by President Lincoln. The original bill for this purpose was introduced in the House in 1857 by Hon. Justin S. Morrill. It was passed, but was vetoed by President Buchanan. In December, 1861, Mr. Morrill introduced his bill again, but on May 2, 1862, Senator Wade offered a similar bill in the Senate, and in June it passed both houses.

The act passed through the efforts of Hon. William Hatch, the Morrill law of 1890 (p. 50), and this act constitute the largest Government aid to education in the history of this country.

[Act of July 2, 1862.]

AN ACT donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there be granted to the several States, for the purposes hereinafter mentioned, an amount of public land, to be apportioned to each State a quantity equal to thirty thousand acres for each Senator and Representative in Congress to which the States are respectively entitled by the apportionment under the census of eighteen hundred and sixty: *Provided,* That no mineral lands shall be selected or purchased under the provisions of this act.

SEC. 2. That the land aforesaid, after being surveyed, shall be apportioned to the several States in sections or subdivisions of sections, not less than one-quarter of a section; and whenever there are public lands in a State subject to sale at private entry at one dollar and twenty-five cents per acre, the quantity to which said State shall be entitled shall be selected from such lands within the limits of such State, and the Secretary of the Interior is hereby directed to issue to each of the States in which there is not the quantity of public lands subject to sale at private entry at one dollar and twenty-five cents per acre, to which said State may be entitled under the provisions of this act, land scrip to the amount in acres for the deficiency of its distributive share; said scrip to be sold by said States and the proceeds thereof applied to the uses and purposes prescribed in this act, and for no other use or purpose whatsoever: *Provided,* That in no case shall any State to which land scrip may thus be issued be allowed to locate the same within the limits of any other State, or of any Territory of the United States, but their assignees may thus locate said land scrip upon any of the unappropriated lands of the United States subject to sale at private entry at one dollar and twenty-five cents, or less, per acre: *And provided further,* That not more than one million acres shall be located by such assignees in any one of the States: *And provided further,* That no such location shall be made before one year from the passage of this act.

SEC. 3. That all the expenses of management, superintendence, and taxes from date of selection of said lands, previous to their sales, and all expenses incurred in the management and disbursement of the moneys which may be received therefrom, shall be paid by the States to which they may belong, out of the treasury of said States, so that the entire proceeds of the sale of said lands shall be applied without any diminution whatever to the purposes hereinafter mentioned.

SEC. 4. That all moneys derived from the sale of the lands aforesaid by the States to which the lands are apportioned, and from the sales of land scrip hereinbefore provided for, shall be invested in stocks of the United States, or of the States, or some other safe stocks, yielding not less than five per centum upon the par value of said stocks; and that the moneys so invested shall constitute a perpetual fund, the capital of which shall remain forever undiminished (except so far as may be provided

in section fifth of this act), and the interest of which shall be inviolably appropriated, by each State which may take and claim the benefit of this act, to the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.

SEC. 5. That the grant of land and land scrip hereby authorized shall be made on the following conditions, to which, as well as to the provisions hereinbefore contained the previous assent of the several States shall be signified by legislative acts:

First. If any portion of the fund invested, as provided by the foregoing section, or any portion of the interest thereon, shall, by any action or contingency, be diminished or lost, it shall be replaced by the State to which it belongs, so that the capital of the fund shall remain forever undiminished; and the annual interest shall be regularly applied without diminution to the purposes mentioned in the fourth section of this act, except that a sum, not exceeding ten per centum upon the amount received by any State under the provisions of this act, may be expended for the purchase of lands for sites or experimental farms, whenever authorized by the respective legislatures of said States.

Second. No portion of said fund, nor the interest thereon, shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation, or repair of any building or buildings.

Third. Any State which may take and claim the benefit of the provisions of this act shall provide, within five years, at least not less than one college, as described in the fourth section of this act, or the grant to such State shall cease; and said State shall be bound to pay the United States the amount received of any lands previously sold, and that the title to purchasers under the State shall be valid.

Fourth. An annual report shall be made regarding the progress of each college, recording any improvements and experiments made, with their cost and results, and such other matters, including State industrial and economical statistics, as may be supposed useful; one copy of which shall be transmitted by mail free, by each, to all the other colleges which may be endowed under the provisions of this act, and also one copy to the Secretary of the Interior.

Fifth. When lands shall be selected from those which have been raised to double the minimum price, in consequence of railroad grants, they shall be computed to the States at the maximum price, and the number of acres proportionately diminished.

Sixth. No State while in a condition of rebellion or insurrection against the Government of the United States shall be entitled to the benefit of this act.

Seventh. No State shall be entitled to the benefits of this act unless it shall express its acceptance thereof by its legislature within two years from the date of its approval by the President.

SEC. 6. That land scrip issued under the provisions of this act shall not be subject to location until after the first day of January, one thousand eight hundred and sixty-three.

SEC. 7. That the land officers shall receive the same fees for locating land scrip issued under the provisions of this act as is now allowed for the location of military bounty land warrants under existing laws: *Provided*, Their maximum compensation shall not be thereby increased.

SEC. 8. That the governors of the several States to which scrip shall be issued under this act shall be required to report annually to Congress all sales made of such scrip until the whole shall be disposed of, the amount received for the same, and what appropriation has been made of the proceeds.

Approved July 2, 1862.

LAW ESTABLISHING AGRICULTURAL EXPERIMENT STATIONS.

[Hatch Act, March 2, 1887.]

AN ACT to establish agricultural experiment stations in connection with the colleges established in the several States under the provisions of an act approved July second, eighteen hundred and sixty-two, and of the acts supplementary thereto.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in order to aid in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiment respecting the principles and applications of agricultural science, there shall be established, under direction of the college or colleges or agricultural department of colleges in each State or Territory established, or which may hereafter be established, in accordance with the provisions of an act approved July second, eighteen hundred and sixty-two, entitled "An act donating public lands to the several States and Territories which may provide colleges for the benefit of agriculture and the mechanic arts," or any of the supplements to said act, a department to be known and designated as an "agricultural experiment station:" *Provided,* That in any State or Territory in which two such colleges have been or may be so established the appropriation hereinafter made to such State or Territory shall be equally divided between such colleges, unless the legislature of such State or Territory shall otherwise direct.

SEC. 2. That it shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories.

SEC. 3. That in order to secure, as far as practicable, uniformity of methods and results in the work of said stations, it shall be the duty of the United States Commissioner of Agriculture to furnish forms, as far as practicable, for the tabulation of results of investigation or experiments; to indicate from time to time such lines of inquiry as to him shall seem most important; and, in general, to furnish such advice and assistance as will best promote the purpose of this act. It shall be the duty of each of said stations annually, on or before the first day of February, to make to the governor of the State or Territory in which it is located a full and detailed report of its operations, including a statement of receipts and expenditures, a copy of which report shall be sent to each of said stations, to the said Commissioner of Agriculture, and to the Secretary of the Treasury of the United States.

SEC. 4. That bulletins or reports of progress shall be published at said stations at least once in three months, one copy of which shall be sent to each newspaper in the States or Territories in which they are respectively located, and to such individuals actually engaged in farming as may request the same, and as far as the means of the station will permit. Such bulletins or reports and the annual reports of said stations shall be transmitted in the mails of the United States free of charge for postage, under such regulations as the Postmaster-General may from time to time prescribe.

SEC. 5. That for the purpose of paying the necessary expenses of conducting investigations and experiments and printing and distributing the results as hereinbefore prescribed, the sum of fifteen thousand dollars per annum is hereby appropriated to

each State, to be specially provided for by Congress in the appropriations from year to year, and to each Territory entitled under the provisions of section eight of this act, out of any money in the Treasury proceeding from the sales of public lands, to be paid in equal quarterly payments on the first day of January, April, July, and October in each year, to the treasurer or other officer duly appointed by the governing boards of said colleges to receive the same, the first payment to be made on the first day of October, eighteen hundred and eighty-seven: *Provided, however,* That out of the first annual appropriation so received by any station an amount not exceeding one-fifth may be expended in the erection, enlargement, or repair of a building or buildings necessary for carrying on the work of such station; and thereafter an amount not exceeding five per centum of such annual appropriation may be so expended.

SEC. 6. That whenever it shall appear to the Secretary of the Treasury from the annual statement of receipts and expenditures of any of said stations that a portion of the preceding annual appropriation remains unexpended, such amount shall be deducted from the next succeeding annual appropriation to such station, in order that the amount of money appropriated to any station shall not exceed the amount actually and necessarily required for its maintenance and support.

SEC. 7. That nothing in this act shall be construed to impair or modify the legal relation existing between any of the said colleges and the government of the States or Territories in which they are respectively located.

SEC. 8. That in States having colleges entitled under this section to the benefits of this act and having also agricultural experiment stations established by law separate from said colleges, such States shall be authorized to apply such benefits to experiments at stations so established by such States; and in case any State shall have established under the provisions of said act of July second, aforesaid, an agricultural department or experimental station, in connection with any university, college, or institution not distinctively an agricultural college or school, and such State shall have established or shall hereafter establish a separate agricultural college or school, which shall have connected therewith an experimental farm or station, the legislature of such State may apply in whole or in part the appropriation by this act made to such separate agricultural college or school, and no legislature shall by contract, express or implied, disable itself from so doing.

SEC. 9. That the grants of moneys authorized by this act are made subject to the legislative assent of the several States and Territories to the purposes of said grants: *Provided,* That payment of such installments of the appropriation herein made as shall become due to any State before the adjournment of the regular session of its legislature meeting next after the passage of this act shall be made upon the assent of the governor thereof duly certified to the Secretary of the Treasury.

SEC. 10. Nothing in this act shall be held or construed as binding the United States to continue any payments from the Treasury to any or all the States or institutions mentioned in this act, but Congress may at any time amend, suspend, or repeal any or all the provisions of this act.

Approved, March 2, 1887.

ENDOWMENT OF AGRICULTURAL COLLEGES.

[Morrill law, August 30, 1890.]

AN ACT to apply a portion of the proceeds of the public lands to the more complete endowment and support of the colleges for the benefit of agriculture and the mechanic arts established under the provisions of an act of Congress approved July second, eighteen hundred and sixty-two.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there shall be, and hereby is, annually appropriated, out of any money in the Treasury not otherwise appropriated, arising from the sales of public lands, to be paid as hereinafter provided, to each State and Territory for the more complete endowment and maintenance of colleges for the benefit of agriculture and the mechanic arts now established, or which may be hereafter established,

in accordance with an act of Congress approved July second, eighteen hundred and sixty-two, the sum of fifteen thousand dollars for the year ending June thirtieth, eighteen hundred and ninety, and an annual increase of the amount of such appropriation thereafter for ten years by an additional sum of one thousand dollars over the preceding year, and the annual amount to be paid thereafter to each State and Territory shall be twenty-five thousand dollars, to be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, with special reference to their applications in the industries of life, and to the facilities for such instruction: *Provided*, That no money shall be paid out under this act to any State or Territory for the support and maintenance of a college where a distinction of race or color is made in the admission of students, but the establishment and maintenance of such colleges separately for white and colored students shall be held to be a compliance with the provisions of this act if the funds received in such State or Territory be equitably divided as hereinafter set forth: *Provided*, That in any State in which there has been one college established in pursuance of the act of July second, eighteen hundred and sixty-two, and also in which an educational institution of like character has been established, or may be hereafter established, and is now aided by such State from its own revenue, for the education of colored students in agriculture and the mechanic arts, however named or styled, or whether or not it has received money heretofore under the act to which this act is an amendment, the legislature of such State may propose and report to the Secretary of the Interior a just and equitable division of the fund to be received under this act between one college for white students and one institution for colored students established as aforesaid, which shall be divided into two parts and paid accordingly, and thereupon such institution for colored students shall be entitled to the benefits of this act and subject to its provisions, as much as it would have been if it had been included under the act of eighteen hundred and sixty-two, and the fulfillment of the foregoing provisions shall be taken as a compliance with the provision in reference to separate colleges for white and colored students.

SEC. 2. That the sums hereby appropriated to the States and Territories for the further endowment and support of colleges shall be annually paid on or before the thirty-first day of July of each year, by the Secretary of the Treasury, upon the warrant of the Secretary of the Interior, out of the Treasury of the United States, to the State or Territorial treasurer, or to such officer as shall be designated by the laws of such State or Territory to receive the same, who shall, upon the order of the trustees of the college, or the institution for colored students, immediately pay over said sums to the treasurers of the respective colleges or other institutions entitled to receive the same, and such treasurers shall be required to report to the Secretary of Agriculture and to the Secretary of the Interior, on or before the first day of September of each year, a detailed statement of the amount so received and of its disbursement. The grants of moneys authorized by this act are made subject to the legislative assent of the several States and Territories to the purpose of said grants: *Provided*, That payments of such installments of the appropriation herein made as shall become due to any State before the adjournment of the regular session of legislature meeting next after the passage of this act shall be made upon the assent of the governor thereof, duly certified to the Secretary of the Treasury.

SEC. 3. That if any portion of the moneys received by the designated officer of the State or Territory for the further and more complete endowment, support, and maintenance of colleges, or of institutions for colored students, as provided in this act, shall, by any action or contingency, be diminished or lost, or be misapplied, it shall be replaced by the State or Territory to which it belongs, and until so replaced no subsequent appropriation shall be apportioned or paid to such State or Territory; and no portion of said moneys shall be applied, directly or indirectly, under any pretense whatever, to the purchase, erection, preservation, or repair of any building or

buildings. An annual report by the president of each of said colleges shall be made to the Secretary of Agriculture, as well as to the Secretary of the Interior, regarding the condition and progress of each college, including statistical information in relation to its receipts and expenditures, its library, the number of its students and professors, and also as to any improvements and experiments made under the direction of any experiment stations attached to said colleges, with their costs and results, and such other industrial and economical statistics as may be regarded as useful, one copy of which shall be transmitted by mail free to all other colleges further endowed under this act.

SEC. 4. That on or before the first day of July in each year, after the passage of this act, the Secretary of the Interior shall ascertain and certify to the Secretary of the Treasury as to each State and Territory whether it is entitled to receive its share of the annual appropriation for colleges, or of institutions for colored students, under this act, and the amount which thereupon each is entitled, respectively, to receive. If the Secretary of the Interior shall withhold a certificate from any State or Territory of its appropriation the facts and reasons therefor shall be reported to the President, and the amount involved shall be kept separate in the Treasury until the close of the next Congress, in order that the State or Territory may, if it should so desire, appeal to Congress from the determination of the Secretary of the Interior. If the next Congress shall not direct such sum to be paid it shall be covered into the Treasury. And the Secretary of the Interior is hereby charged with the proper administration of this law.

SEC. 5. That the Secretary of the Interior shall annually report to Congress the disbursements which have been made in all the States and Territories, and also whether the appropriation of any State or Territory has been withheld, and if so, the reasons therefor.

SEC. 6. Congress may at any time amend, suspend, or repeal any or all of the provisions of this act.

Approved, August 30, 1890.

Statement of appropriations, disbursements, and unexpended balances for the United States Department of Agriculture from the fiscal year 1839 to the fiscal year 1897, inclusive.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.		Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.				
Collection of agricultural statistics, etc.	Mar. 3, 1839	5	354	9	1839	\$1,000.00	.....
	Aug. 26, 1842	5	533	26	1842	1,000.00	.....
	Mar. 3, 1843	5	642	1	1844	2,000.00	.....
	June 17, 1844	5	687	1	1845	2,000.00	.....
	Mar. 3, 1845	5	757	1	1846	3,000.00	.....
Chemical analyses of vegetable substances.	Mar. 3, 1847	9	160	1	1847	3,000.00	.....
	Aug. 12, 1848	9	285	1	1848	3,500.00	.....
	do.	9	285	1	1848	1,000.00	.....
	Mar. 3, 1849	9	364	1	1849	3,500.00	.....
	do.	9	364	1	1850	1,000.00	.....
Collection of agricultural statistics.	Sept. 30, 1850	9	541	1	1850	4,500.00	.....
	Mar. 3, 1851	9	615	1	1851	5,500.00	.....
	Aug. 31, 1852	10	95	1	1852	5,000.00	.....
	Mar. 3, 1853	10	208	1	1853	5,000.00	.....
	May 31, 1854	10	292	1	1854	10,000.00	.....
Collection of agricultural statistics and purchase of seeds.	Aug. 4, 1854	10	567	1	1855	50,000.00	.....
	Mar. 3, 1855	10	664	1	1856	30,000.00	.....
	May 15, 1856	11	14	1	1857	75,000.00	.....
	Aug. 18, 1856	11	89	1	1858	60,000.00	.....
	Mar. 3, 1857	11	226	1	1858	3,157.25	\$342.75
Information in relation to consumption of cotton.	do.	11	226	1	1858	3,500.00	.....
	June 12, 1858	11	321	1	1859	60,000.00	.....
	Mar. 3, 1859	11	427	1	1860	40,000.00	.....
	June 25, 1860	12	108	1	1861	60,000.00	.....
	Mar. 2, 1861	12	217	1	1861	60,000.00	.....
Collection of agricultural statistics, etc., and purchase, etc., of seeds.	Feb. 13, 1862	12	338	1	1862	64,000.00	63,704.21
	Mar. 1, 1862	12	350	1	1863	80,000.00	.....
	Feb. 25, 1863	12	691	1	1864	5,000.00	.....
	do.	12	691	1	1864	87,000.00	.....
	do.	12	691	1	1864	3,000.00	.....
Culture of cotton and tobacco.	do.	12	691	1	1864	20,000.00	10,500.00
	do.	12	23	1	1864	2,000.00	.....
	Mar. 14, 1864	13	23	1	1864	800.00	.....
	do.	13	23	1	1864	1,320.00	.....
	do.	13	23	1	1864	650.00	.....
Purchase of sorghum seed.	do.	13	23	1	1864	38,300.00	.....
	do.	13	155	2	1865	3,500.00	.....
	June 25, 1864	13	350	1	1865	20,000.00	.....
	July 2, 1864	13	136	1	1865	800.00	.....
	do.	13	155	1	1865	800.00	.....
To rebuild shop in propagating garden.	do.	13	155	1	1865	800.00	.....
	Postage	13	23	1	1864	650.00	.....
	Furniture, carpets, fuel, etc.	13	23	1	1864	38,300.00	.....
	Salaries	13	155	2	1865	3,500.00	.....
	Contingent expenses	13	136	1	1865	20,000.00	.....
Collecting agricultural statistics.	June 25, 1864	13	350	1	1865	800.00	.....
	do.	13	136	1	1865	800.00	.....
	do.	13	155	1	1865	800.00	.....
	do.	13	155	1	1865	800.00	.....
	do.	13	155	1	1865	800.00	.....

HISTORICAL SKETCH OF DEPARTMENT OF AGRICULTURE.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.		Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.				
Library and laboratory.....	June 25, 1864	13	155	1865	\$4,000.00	\$4,000.00	.....
Purchase and distribution of seeds.....	do	13	155	1865	61,000.00	61,000.00	.....
Experimental garden and grounds.....	do	13	155	1865	15,800.00	15,800.00	.....
To pay a debt incurred in preparing the Agricultural Report for 1861.....	July 2, 1864	13	350	1865	3,704.05	3,596.55	\$107.50
Rent, etc., of Commissioner's office.....	July 4, 1864	13	381	1865	3,500.00	3,500.00	.....
Salaries.....	Mar. 2, 1865	13	160	1866	46,726.59	46,726.59	.....
Contingent expenses.....	do	13	455	1866	7,500.00	7,500.00	.....
Collecting agricultural statistics.....	do	13	455	1866	20,000.00	20,000.00	.....
Purchase, etc., of seeds.....	do	13	160	1866	70,165.90	70,165.90	.....
Experimental garden and grounds, etc.....	do	13	455	1866	23,395.33	23,395.33	.....
Salaries.....	do	13	160	1866	39,600.00	39,600.00	.....
Contingent expenses.....	July 23, 1866	14	201	1867	11,500.00	11,500.00	.....
Collecting agricultural statistics.....	do	14	201	1867	10,000.00	10,000.00	.....
Purchase of seeds.....	do	14	201	1867	115,200.00	115,200.00	.....
Experimental garden and grounds, etc.....	Mar. 30, 1867	15	28	1867	22,800.00	22,800.00	.....
Salaries.....	July 23, 1866	14	202	1868	38,020.00	38,020.00	.....
Contingent expenses.....	Mar. 2, 1867	14	451	1868	13,000.00	13,000.00	.....
Collecting agricultural statistics.....	do	14	451	1868	10,000.00	8,406.34	1,593.66
Purchase, etc., of seeds.....	do	14	451	1868	85,200.00	85,200.00	.....
Museum.....	do	14	452	1868	10,000.00	10,000.00	.....
Experimental garden and grounds.....	do	14	452	1868	22,800.00	22,800.00	.....
To erect a building for the Department of Agriculture.....	do	14	452	1868	100,000.00	99,668.00	332.00
For certain goods and services furnished the Department.....	do	14	454	1868	37,604.70	37,604.70	.....
Salaries.....	July 13, 1868	15	90	1869	65,368.00	65,368.00	.....
Contingent agricultural statistics.....	July 20, 1868	15	105	1869	10,000.00	10,000.00	.....
Contingent expenses.....	do	15	106	1869	31,090.00	31,090.00	.....
Experimental garden and grounds.....	do	15	106	1869	23,500.00	23,500.00	.....
Purchase, etc., of seeds.....	do	15	106	1869	20,000.00	20,000.00	.....
Furniture, cases, and repairs.....	do	15	106	1869	22,635.00	22,635.00	.....
Salaries.....	Mar. 3, 1869	15	297	1870	69,240.00	67,720.00	1,520.00
Collecting agricultural statistics.....	do	15	298	1870	15,000.00	15,000.00	.....
Investigations of cattle disease.....	do	15	298	1870	12,695.60	12,695.60	2,304.40
Contingent expenses.....	do	15	298	1870	13,200.00	13,200.00	.....
Furniture, cases, and repairs.....	do	15	298	1870	2,500.00	2,500.00	.....
Experimental garden and grounds.....	do	15	298	1870	21,500.00	21,500.00	.....
Purchase, etc., of seeds.....	do	15	298	1870	20,000.00	18,981.33	1,018.67

Salaries.....	July 12, 1870	16	245	1}	1871	71,980.00	71,811.64	108.36
Collecting agricultural statistics.....	July 15, 1870	16	314	1}	1871	15,000.00	15,000.00	---
Purchase, etc., of seeds.....	July 12, 1870	16	245	1}	1871	30,000.00	28,865.17	1,134.83
Experimental garden and grounds.....	do	16	246	1}	1871	53,200.00	53,200.00	---
Contingent expenses.....	July 15, 1870	16	302	1}	1871	8,100.00	8,100.00	---
Furniture, cases, and repairs.....	July 12, 1870	16	303	1}	1871	4,700.00	4,700.00	---
Collecting and modeling specimens of fruit.....	do	16	246	1}	1871	1,000.00	1,000.00	---
Library.....	do	16	246	1}	1871	1,000.00	1,000.00	---
Herbarium.....	do	16	246	1}	1871	1,000.00	1,000.00	---
Laboratory.....	do	16	246	1}	1871	1,700.00	1,700.00	---
Folding room.....	do	16	246	1}	1871	500.00	500.00	---
Salaries.....	Mar. 3, 1871	16	489	1}	1872	75,170.00	75,017.89	152.11
Collecting agricultural statistics.....	do	16	489	1}	1872	15,000.00	14,059.36	940.64
Purchase and distribution of seeds, etc.....	do	16	489	1}	1872	45,000.00	45,000.00	---
Experimental garden and grounds.....	do	16	509	1}	1872	36,800.00	36,800.00	---
Contingent expenses.....	do	16	489	1}	1872	12,900.00	12,900.00	---
Furniture, cases, and repairs.....	do	16	490	1}	1872	4,700.00	4,700.00	---
Collecting and modeling specimens of fruit.....	do	16	490	1}	1872	1,000.00	1,000.00	---
Herbarium.....	do	16	490	1}	1872	1,000.00	1,000.00	---
Library.....	do	16	490	1}	1872	2,050.00	2,050.00	---
Laboratory.....	do	16	490	1}	1872	3,450.00	3,450.00	---
Salaries.....	May 8, 1872	17	77	1}	1873	75,890.00	75,889.73	27
Collecting agricultural statistics.....	do	17	77	1}	1873	15,000.00	15,000.00	---
Purchase and distribution of seeds.....	do	17	77	1}	1873	55,000.00	55,000.00	---
Experimental garden and grounds.....	do	17	368	1}	1873	31,000.00	31,000.00	---
Contingent expenses.....	June 10, 1872	17	77	1}	1873	13,300.00	12,507.06	792.94
Folding room.....	May 8, 1872	17	78	1}	1873	300.00	300.00	---
Furniture, cases, and repairs.....	do	17	78	1}	1873	5,200.00	5,200.00	---
Museum and herbarium.....	do	17	78	1}	1873	5,000.00	4,674.43	325.57
Library.....	June 10, 1872	17	369	1}	1873	1,750.00	1,750.00	---
Salaries.....	May 8, 1872	17	78	1}	1873	76,924.00	76,924.00	---
Collecting agricultural statistics.....	Mar. 3, 1873	17	506	1}	1874	15,000.00	11,553.20	1,266.00
Purchase and distribution of seeds, etc.....	do	17	506	1}	1874	65,000.00	64,904.89	95.11
Experimental garden and grounds.....	do	17	540	1}	1874	26,200.00	25,731.74	468.26
Museum and herbarium.....	do	17	529	1}	1874	2,000.00	1,942.02	57.98
Contingent expenses.....	do	17	507	1}	1874	13,600.00	12,699.34	900.66
Furniture, cases, and repairs.....	do	17	507	1}	1874	4,200.00	3,302.40	897.60
Library.....	do	17	507	1}	1874	1,500.00	1,259.10	240.90
Postage.....	do	17	542	4}	1874	52,000.00	35,439.09	16,550.91
Salaries.....	June 20, 1874	18	107	1}	1875	77,180.00	77,127.60	52.40
Collecting agricultural statistics.....	do	18	107	1}	1875	15,000.00	12,147.56	2,852.44

Statement of appropriations, disbursements, and unexpended balances for the Department of Agriculture, 1839-1897—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.		Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
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Purchase and distribution of seeds, etc.	June 20, 1874	18	107	1875	\$95,000.00	\$94,719.83	\$280.17
Furniture, cases, and repairs.	Jan. 25, 1875	18	303	1875	4,200.00	4,135.36	64.64
Experimental garden and grounds.	June 20, 1874	18	107	1875	24,100.00	24,094.06	5.94
Contingent expenses.	June 23, 1874	18	227	1875	12,800.00	10,972.61	1,827.39
Museum and herbarium.	June 20, 1874	18	107	1875	4,500.00	3,300.00	1,200.00
Laboratory.	June 23, 1874	18	227	1875	1,300.00	1,300.00	
Postage.	do	18	227	1875	1,500.00	1,087.90	412.10
To publish Commissioner's report for the years 1872 and 1873.	June 20, 1874	18	107	1875	52,000.00	42,633.00	9,367.00
Salaries.	June 23, 1874	18	227	1875	50,000.00	49,561.91	438.09
Collecting agricultural statistics.	Mar. 3, 1875	18	268	1876	77,180.00	77,115.71	64.29
Purchase and distribution of seeds.	do	18	368	1876	15,000.00	14,500.00	500.00
Experimental garden and grounds.	do	18	368	1876	65,000.00	65,000.00	
Museum and herbarium.	do	18	368	1876	19,990.00	19,956.11	33.89
Furniture, cases, and repairs.	do	18	368	1876	2,000.00	1,993.55	6.45
Laboratory.	do	18	368	1876	3,300.00	3,124.23	175.77
Contingent expenses.	do	18	368	1876	1,250.00	1,046.84	203.16
Postage.	do	18	368	1876	1,300.00	1,300.00	
Salaries.	do	18	368	1876	52,100.00	11,378.91	721.09
Experimental garden and grounds.	July 21, 1876	19	95	1877	52,000.00	3,428.29	48,571.71
Collecting agricultural statistics.	Aug. 15, 1876	19	167	1877	67,836.95	67,806.19	30.77
Purchase and distribution of seeds, etc.	July 31, 1876	19	115	1877	11,550.00	11,550.00	
Museum and herbarium.	do	19	167	1877	10,000.00	10,000.00	
Furniture, cases, and repairs.	Mar. 3, 1877	19	317	1877	85,000.00	80,000.00	5,000.00
Laboratory.	Aug. 15, 1876	19	167	1877	2,000.00	2,000.00	
Contingent expenses.	do	19	167	1877	2,000.00	2,000.00	
Postage.	do	19	167	1877	1,000.00	800.00	200.00
Salaries.	do	19	167	1877	1,300.00	1,300.00	
Collecting agricultural statistics.	do	19	167	1877	10,000.00	8,800.00	1,200.00
Purchase and distribution of seeds, etc.	Mar. 3, 1877	19	317	1878	4,000.00	3,950.00	50.00
Experimental garden and grounds.	do	19	317	1878	65,640.00	65,640.00	
	do	19	317	1878	15,000.00	15,000.00	
	do	19	317	1878	75,000.00	74,979.33	490.67
	do	19	360	1878	10,500.00	10,500.00	

Museum	do	19	317	1	1878	1,500.00	1,500.00	-----
Furniture, cases, and repairs	do	19	317	1	1878	4,500.00	4,500.00	-----
Laboratory	do	19	317	1	1878	1,000.00	1,000.00	-----
Contingent expenses	do	19	317	1	1878	1,000.00	1,000.00	-----
Postage	do	19	317	1	1878	8,000.00	8,000.00	-----
Report on forestry	do	19	317	1	1878	4,000.00	3,415.61	584.39
International Industrial Exposition at Paris	do	19	380	1	1878	2,500.00	2,500.00	-----
Salaries	Dec. 15, 1877	20	246	4	1878	10,000.00	10,000.00	-----
Collecting agricultural statistics	June 19, 1878	20	203	1	1879	66,900.00	66,900.00	-----
Purchase and distribution of seeds, etc.	do	20	203	1	1879	10,000.00	10,000.00	-----
Experimental garden and grounds	do	20	203	1	1879	75,000.00	75,000.00	-----
Museum	do	20	240	1	1879	13,500.00	13,500.00	-----
Furniture, cases, and repairs	do	20	203	1	1879	1,000.00	1,000.00	-----
Laboratory	do	20	204	1	1879	4,000.00	4,000.00	-----
Contingent expenses	do	20	204	1	1879	1,000.00	1,000.00	-----
Postage	do	20	204	1	1879	1,500.00	1,500.00	-----
Investigating the history and habits of insects	do	20	204	1	1879	8,000.00	8,000.00	-----
Investigating diseases of domestic animals	do	20	204	1	1879	4,000.00	3,960.00	-----
To erect a stable	Mar. 3, 1879	20	240	1	1879	10,000.00	10,000.00	-----
Salaries	June 21, 1879	20	392	1	1879	1,500.00	1,500.00	-----
Collecting agricultural statistics	do	21	23	1	1880	66,900.00	66,900.00	-----
Purchase and distribution of seeds, etc.	do	21	23	1	1880	10,000.00	9,982.88	17.12
Experimental garden and grounds	do	21	23	1	1880	75,000.00	75,000.00	-----
Museum	do	21	23	1	1880	13,100.00	13,100.00	-----
Furniture, cases, and repairs	do	21	23	1	1880	1,000.00	1,000.00	-----
Laboratory	do	21	23	1	1880	4,000.00	4,000.00	-----
Contingent expenses	do	21	23	1	1880	1,000.00	1,000.00	-----
Postage	do	21	23	1	1880	1,500.00	1,500.00	-----
Investigating the history and habit of insects	do	21	23	1	1880	8,000.00	8,000.00	-----
Investigating diseases of domestic animals	do	21	23	1	1880	4,000.00	4,000.00	-----
Salaries	do	21	29	1	1880	5,000.00	5,000.00	-----
Purchase and distribution of seeds, etc.	do	21	30	1	1880	10,000.00	8,878.84	1,121.16
Collecting agricultural statistics	June 16, 1880	21	292	1	1881	69,200.00	69,185.22	14.78
Experimental garden and grounds	do	21	294	1	1881	102,160.31	102,157.48	2.83
Museum	May 3, 1881	21	453	1	1881	10,000.00	9,985.60	14.40
Furniture, cases, and repairs	do	21	293	1	1881	12,600.00	12,600.00	-----
Laboratory	do	21	294	1	1881	1,000.00	1,000.00	-----
Contingent expenses	do	21	294	1	1881	1,000.00	1,000.00	-----
Postage	do	21	294	1	1881	5,000.00	5,000.00	-----
Report on forestry	do	21	294	1	1881	1,000.00	1,000.00	-----
Investigating the history and habits of insects	do	21	295	1	1881	4,000.00	4,000.00	-----
Investigating diseases of domestic animals	do	21	295	1	1881	10,000.00	9,769.17	230.83
Examination of fibers	do	21	295	1	1881	3,638.00	3,638.00	-----
Experiments in the manufacture of sugar	do	21	295	1	1881	5,000.00	3,762.51	1,237.49
	do	21	294	1	1881	5,000.00	4,897.31	2.69
	do	21	295	1	1881	10,000.00	10,000.00	-----
	do	21	295	1	1881	4,000.00	4,000.00	-----
	do	21	295	1	1881	7,500.00	7,500.00	-----

Statement of appropriations, disbursements, and unexpended balances for the Department of Agriculture, 1839-1897—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.		Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
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Collecting data touching arid regions of the United States.	June 16, 1880	21	295	1881	\$5,000.00	\$460.00	\$4,540.00
Reclamation of arid lands	do	21	295	1881	20,000.00	78,353.55	(¹)
Salaries	Mar. 3, 1881	21	381	1882	79,500.00	79,491.81	8, 19
Collecting agricultural statistics	do	21	382	1882	10,000.00	10,000.00	188.15
Laboratory	do	21	382	1882	6,000.00	5,811.85	188.15
Purchase and distribution of seeds, etc	do	21	382	1882	100,000.00	99,991.53	8.47
Experiments in the culture, etc., of tea	Apr. 16, 1882	22	44	1882	10,000.00	8,750.87	1,249.13
Experimental garden and grounds	Mar. 3, 1881	21	383	1882	15,000.00	14,968.25	31.75
Museum	do	21	385	1882	1,000.00	1,000.00	-----
Furniture, cases, and repairs	do	21	383	1882	4,000.00	4,000.00	-----
Library	do	21	383	1882	1,000.00	973.85	26.15
Investigating the history and habits of insects	do	21	383	1882	20,000.00	19,998.94	1.06
Examination of fibers	do	21	384	1882	5,000.00	5,000.00	-----
Investigating the diseases of domestic animals	do	21	384	1882	25,000.00	22,443.89	2,556.11
Collecting data touching the arid regions of the United States	do	21	384	1882	5,000.00	4,216.55	783.45
Reclamation of arid lands, including an unexpended balance of \$1,646.45 from fiscal year 1881	do	21	384	1882	11,646.45	11,561.19	(²)
Report on forestry	do	21	384	1882	5,000.00	4,941.00	59.00
Postage	do	21	384	1882	4,000.00	4,000.00	-----
Contingent expenses	do	21	384	1882	10,000.00	10,000.00	-----
Building for display of agricultural implements	do	21	385	1882	10,000.00	10,000.00	-----
Experiments in the manufacture of sugar (including \$864.60 from sale of molasses, etc.)	do	21	384	1882	35,864.60	32,333.75	(³)
Transportation of specimens from Atlanta	Feb. 13, 1882	22	3	1882	5,000.00	4,998.91	1.09
Salaries	May 19, 1882	22	89	1883	102,580.00	102,575.49	4.51
Collecting agricultural statistics	do	22	90	1883	80,000.00	78,170.80	1,829.20
Laboratory	do	22	90	1883	6,000.00	6,000.00	-----
Purchase and distribution of seeds, etc.	do	22	90	1883	80,000.00	80,000.00	-----
Experiments in the culture, etc., of tea	do	22	91	1883	5,000.00	3,905.66	1,094.34
Experimental garden and grounds	do	22	91	1883	15,500.00	15,471.82	28.18
Museum	do	22	92	1883	1,000.00	1,000.00	-----
Furniture, cases, and repairs	do	22	91	1883	6,700.00	6,700.00	-----
Library	do	22	91	1883	1,500.00	1,485.32	14.68
Investigating the history and habits of insects	do	22	91	1883	20,000.00	19,997.75	2.25
Examination of fibers	do	22	91	1883	10,000.00	7,961.94	2,038.06
Investigating the diseases of domestic animals	do	22	92	1883	25,000.00	21,584.28	3,415.72
Reclamation of arid lands, including an unexpended balance of \$85.26 from fiscal year 1882	do	22	92	1883	20,085.25	12,429.13	(⁴)
Report on forestry	do	22	92	1883	10,000.00	8,731.90	1,268.01
Postage	do	22	92	1883	4,000.00	3,977.49	22.51
Contingent expenses	do	22	92	1883	15,000.00	14,920.74	79.26

Experiments in the manufacture of sugar, including an unexpended balance of \$3,530.85 from fiscal year 1882.	do.	22	92	1	1883	28,530.85	28,530.31	1.54
Erection of building for seed division	Aug. 7, 1882	22	306	1	1883	25,000.00	25,000.00	
Report on the Angora goat	do.	22	337	1	1883	500.00	500.00	
Salaries	Jan. 20, 1883	22	408	1	1884	127,640.00	127,639.87	239.14
Collecting agricultural statistics	do.	22	410	1	1884	80,000.00	79,770.86	
Laboratory, and for experiments in the manufacture of sugar, including \$842.18 from the sale of syrup, etc.	do.	22	410	1	1884	16,842.18	16,829.26	12.92
Purchase and distribution of seeds, etc.	do.	22	410	1	1884	75,000.00	74,986.48	13.52
Experimental gardens and grounds	do.	22	409	1	1884	15,500.00	15,448.87	51.13
Experimental gardens and grounds	do.	22	411	1	1884	1,000.00	993.51	6.49
Museum	do.	22	409	1	1884	6,000.00	5,998.82	1.18
Furniture, cases, and repairs	do.	22	410	1	1884	1,500.00	1,439.86	60.14
Library	do.	22	411	1	1884	20,002.82	20,002.82	
Investigating the history and habits of insects	do.	22	409	1	1884	20,002.82	20,002.82	
Reclamation of arid lands, including an unexpended balance of \$7,656.13 from fiscal year 1883.	Aug. 4, 1886	24	273	1	1884	17,656.13	16,164.68	1,491.45
Investigating the diseases of domestic animals	Jan. 20, 1883	22	411	1	1884	25,000.00	24,011.85	988.15
Report on forestry	do.	22	411	1	1884	10,000.00	9,998.30	1.70
Postage	do.	22	411	1	1884	4,000.00	3,841.48	158.52
Contingent expenses	do.	22	411	1	1884	14,000.00	13,981.43	8.57
Building of greenhouse	do.	22	631	1	1884	2,500.00	2,500.00	
Salaries	June 5, 1884	23	36	1	1885	137,590.00	137,557.80	32.20
Collecting agricultural statistics	do.	23	38	1	1885	100,000.00	99,986.59	13.41
Bureau of Animal Industry	do.	23	31	1	1885	150,000.00	56,807.73	(^e)
Purchase and distribution of seeds, etc.	May 29, 1884	23	38	1	1885	100,000.00	99,983.82	16.18
Laboratory, and for experiments in the manufacture of sugar	June 5, 1884	23	38	1	1885	50,000.00	49,996.70	3.30
Investigating the history and habits of insects	do.	23	38	1	1885	20,000.00	19,986.83	13.17
Silk culture	do.	23	37	1	1885	15,000.00	14,916.23	83.77
Contingent expenses	do.	23	39	1	1885	15,000.00	14,862.20	137.80
Report on forestry	do.	23	39	1	1885	10,000.00	9,987.36	12.64
Experimental garden and grounds	do.	23	37	1	1885	17,840.25	17,513.67	326.58
Furniture, cases, and repairs	Oct. 19, 1883	25	581	1	1885	6,000.00	5,947.27	52.73
Postage	June 5, 1884	23	38	1	1885	4,000.00	3,956.98	43.02
Experiments in the culture, etc., of tea	do.	23	39	1	1885	3,000.00	2,998.90	1.10
Library	do.	23	39	1	1885	1,500.00	1,403.63	96.37
Museum	do.	23	39	1	1885	1,000.00	1,000.00	
Quarantine stations	June 7, 1884	23	37	1	1885	25,000.00	22,029.18	2,970.82
Salaries	Mar. 3, 1885	23	207	1	1886	137,590.00	137,337.42	252.58
Collecting agricultural statistics	do.	23	353	1	1886	75,000.00	68,723.06	6,276.94
Bureau of Animal Industry, including an unexpended balance of \$93,192.27 from fiscal year 1885.	do.	23	355	1	1886	193,192.27	58,261.05	134,931.22
Quarantine stations, including an unexpended balance of \$2,970.82 for fiscal year 1885.	do.	23	356	1	1886	32,970.82	18,958.57	14,012.25
Purchase and distribution of seeds, etc.	do.	23	354	1	1886	100,000.00	99,980.24	19.76
Laboratory, and for experiments in the manufacture of sugar	do.	23	354	1	1886	40,000.00	39,942.11	57.89
Investigating the history and habits of insects	do.	23	354	1	1886	25,000.00	24,976.46	23.54

Unexpended balance of \$7 656 13 carried to fiscal year 1884.

Unexpended balance of \$93,000.00 carried to fiscal year 1886.

Unexpended balance of \$2,970.82 carried to fiscal year 1886.

Вопросы, связанные с применением

Statement of appropriations, disbursements, and unexpended balances for the Department of Agriculture, 1839-1897—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.			Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.	Sec.				
Silk culture.....	Mar. 3, 1885	23	356	1	1886	\$15,012.00	\$15,008.50	\$3.50
Contingent expenses.....	Oct. 19, 1888	25	581	1	1886	15,000.00	14,937.62	62.38
Report on forestry.....	Mar. 3, 1885	23	356	1	1886	10,000.00	9,886.83	163.17
do.....	do.....	23	254	1	1886			
do.....	do.....	24	273	1	1886	17,008.13	17,024.88	183.25
Experimental garden and grounds.....	Aug. 4, 1886	25	581	1	1886			
Furniture, cases, and repairs.....	Oct. 19, 1888	25	581	1	1886	7,500.00	7,423.59	76.41
Postage.....	Mar. 3, 1885	23	356	1	1886	4,000.00	2,556.20	1,443.80
Experiments in the culture, etc., of tea.....	do.....	23	356	1	1886	3,000.00	1,813.67	1,186.33
Library.....	do.....	23	356	1	1886	1,500.00	1,417.03	82.97
Museum.....	do.....	23	355	1	1886	1,000.00	998.88	1.12
Salaries.....	do.....	23	354	1	1886	142,890.00	141,420.68	1,469.32
Collecting agricultural statistics.....	June 30, 1886	24	100	1	1887	65,000.00	64,955.14	44.86
Bureau of Animal Industry.....	do.....	24	103	1	1887	100,000.00	99,985.56	14.44
Quarantine stations.....	do.....	24	103	1	1887	30,000.00	10,639.44	19,360.56
Purchase and distribution of seeds, etc.....	do.....	24	102	1	1887	100,000.00	99,998.37	1.63
Laboratory.....	do.....	24	101	1	1887	6,000.00	4,570.86	1,429.14
Experiments in the manufacture of sugar, including \$1,891 from sales.....	do.....	24	101	1	1887	95,891.00	95,853.14	37.86
Investigating the history and habits of insects.....	do.....	24	101	1	1887	15,096.25	15,088.05	8.20
Silk culture, including \$864.81 from sale of raw silk.....	Oct. 19, 1888	25	582	1	1887	15,998.56	15,998.56	---
Contingent expenses.....	June 30, 1886	24	101	1	1887	15,998.83	14,936.50	63.17
Report on forestry.....	Oct. 19, 1888	25	581	1	1887	8,000.00	7,958.50	46.50
Experimental garden and grounds.....	June 30, 1886	24	104	1	1887	23,200.00	22,202.15	997.85
Furniture, cases, and repairs.....	do.....	24	103	1	1887	8,125.00	8,092.11	32.89
Postage.....	do.....	24	103	1	1887	4,000.00	3,500.00	500.00
Experiments in the culture, etc., of tea.....	do.....	24	104	1	1887	2,000.00	1,753.78	246.22
Pomological information.....	do.....	24	100	1	1887	3,000.00	2,993.20	6.80
Library.....	do.....	24	103	1	1887	1,500.00	1,428.65	71.35
Botanical investigations.....	do.....	24	100	1	1887	5,000.00	4,988.12	11.88
Museum.....	do.....	24	102	1	1887	1,000.00	998.88	1.12
Ornithology and mammalogy.....	do.....	24	101	1	1887	10,000.00	9,999.98	02
Reclamation of arid lands.....	do.....	24	163	1	1887	5,000.00	---	5,000.00
Adulteration of food.....	do.....	24	100	1	1887	1,000.00	989.14	10.86
Salaries.....	Mar. 3, 1887	24	495	1	1888	161,490.00	158,220.87	3,269.13
Collecting agricultural statistics.....	do.....	24	498	1	1888	65,000.00	64,965.33	34.67
Bureau of Animal Industry, including \$100,000 immediately available.....	do.....	24	499	1	1888	500,000.00	499,975.32	24.68
Quarantine stations.....	do.....	24	499	1	1888	20,000.00	9,538.75	10,461.25
Purchase and distribution of seeds, etc.....	do.....	24	498	1	1888	103,000.00	102,587.55	412.45

Laboratory	do	24	497	1	1888	6,000.00	5,999.89	30.11
Experiments in the manufacture of sugar	do	24	497	1	1888	50,000.00	49,997.43	2.57
Experiments in the manufacture of sugar (deficiency)	do	25	582	1	1887	8,000.00	7,927.50	72.50
Investigating the history and habits of insects	Oct. 19, 1888	24	497	1	1888	20,000.00	20,000.00	
Silk culture, including \$1,989.00 from sale of raw silk	Mar. 3, 1887	24	497	1	1888	16,989.06	16,989.02	04
Contingent expenses	do	24	490	1	1888	15,000.00	14,825.57	174.43
Report on forestry	do	24	499	1	1888	8,000.00	7,996.10	3.90
Experimental garden and grounds	do	24	497	1	1888	24,800.00	24,706.86	93.14
Furniture, cases, and repairs	do	24	498	1	1888	7,000.00	6,982.88	17.12
Postage	do	24	490	1	1888	4,000.00	3,000.00	1,000.00
Pomological information	do	24	497	1	1888	3,000.00	2,971.69	28.31
Library	do	24	497	1	1888	2,000.00	1,983.78	16.22
Botanical investigations	do	24	496	1	1888	7,000.00	6,997.28	2.72
Museum	do	24	497	1	1888	1,000.00	947.41	52.59
Ornithology and mammalogy	do	24	497	1	1888	3,940.00	3,869.23	70.77
Acclimation of food	do	24	497	1	1888	1,000.00	880.16	189.84
Salaries	July 18, 1888	25	528	1	1889	171,890.32	169,152.51	2,737.81
Collecting agricultural statistics	Mar. 2, 1889	25	923	1	1889	70,000.00	69,162.45	837.55
Botanical investigations	July 18, 1888	25	332	1	1889	35,000.00	22,076.75	(1)
Investigating the history and habits of insects	do	25	330	1	1889			
	do	25	331	1	1889			
	do	25	525	1	1889	20,131.64	20,131.64	
Ornithology and mammalogy	Sept. 30, 1890	26	525	1	1889			
	July 18, 1888	25	332	1	1889	5,025.90	5,022.06	3.84
	Mar. 2, 1889	25	838	1	1889			
	Sept. 30, 1890	26	525	1	1889			
	Mar. 3, 1891	26	880	1	1889			
Pomological information	July 18, 1888	25	330	1	1889	4,024.48	4,020.32	4.16
Microscopical investigations	do	25	526	1	1889	1,000.00	999.87	.13
Laboratory	Mar. 2, 1889	25	330	1	1889			
Forestry investigations	Mar. 2, 1889	25	837	1	1889	11,000.00	9,994.25	1,005.75
Purchase and distribution of seeds	July 18, 1888	25	333	1	1889	8,000.00	7,999.03	.97
Experimental gardens and grounds	do	25	332	1	1889	104,200.00	104,168.73	31.27
Museum	do	25	332	1	1889	26,640.00	26,639.83	.17
Furniture, cases, and repairs	do	25	332	1	1889	1,000.00	891.25	108.75
Library	do	25	333	1	1889	7,350.00	7,236.74	113.26
Postage	do	25	333	1	1889	2,000.00	1,956.34	43.66
Contingent expenses	do	25	333	1	1889	4,000.00	4,000.00	
Office of Experiment Stations	Mar. 3, 1891	25	333	1	1889	15,010.00	15,009.22	.78
Experiments in the manufacture of sugar	July 18, 1888	26	881	1	1889	10,000.00	9,033.77	966.23
Quarantine stations	do	25	333	1	1889	100,000.00	41,635.24	(2)
Bureau of Animal Industry	do	25	333	1	1889	15,000.00	11,628.39	3,371.61
Silk culture, including \$708.26 from sale of raw silk	do	25	333	1	1889	500,000.00	479,623.57	20,376.43
Salaries	do	25	331	1	1889	23,208.26	23,208.26	
Collecting agricultural statistics	Mar. 2, 1889	25	885	1	1890	178,580.00	175,547.04	3,032.96
	do	25	839	1	1890	75,000.00	74,327.51	672.49

2 Unexpended balance of \$58,364.76 carried to fiscal year 1890.

1 Unexpended balance of \$12,923.25 carried to fiscal year 1890.

Statement of appropriations, disbursements, and unexpended balances for the Department of Agriculture, 1839-1897—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.		Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
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Botanical investigations, including an unexpended balance of \$12,923.25 from fiscal year 1889	Mar. 2, 1889	25	836	1890	\$48,009.25	\$47,990.38	\$18.87
Investigating the history and habits of insects	July 28, 1892	27	296	1891	20,000.00	19,892.72	107.28
Ornithology and mammalogy	Mar. 2, 1889	25	837	1890	7,000.00	6,994.16	5.84
	do	25	838	1890			
	do	26	285	1891			
Pomological information	July 14, 1890	26	285	1891	4,304.79	4,304.79	
	Mar. 2, 1889	25	837	1890			
	Mar. 3, 1891	26	881	1891			
Microscopical investigations	Mar. 2, 1889	25	837	1890	1,062.50	1,062.50	
	July 28, 1892	27	296	1891			
Laboratory	Mar. 2, 1889	25	837	1890	6,000.00	5,461.99	538.01
Forestry investigations	do	25	840	1890	8,000.00	7,999.96	.04
Purchase and distribution of seeds	do	25	839	1890	104,174.55	104,174.55	25.45
Experimental garden and grounds	do	25	838	1890	26,640.00	26,478.45	161.55
Museum	do	25	838	1890	1,000.00	998.39	1.61
	do	25	839	1890			
Furniture, cases, and repairs	do	25	839	1890	9,350.00	9,261.93	88.07
Library	Apr. 4, 1890	26	42	1890	2,000.00	1,738.28	261.72
Postage	Mar. 2, 1889	25	839	1890	4,000.00	4,000.00	
	do	25	840	1890			
	do	25	840	1890			
Contingent expenses	Apr. 4, 1890	26	42	1890	20,000.00	19,965.32	34.68
	Mar. 2, 1889	25	840	1890	15,000.00	14,991.89	8.31
Office of Experiment Stations	do	25	840	1890	83,364.76	83,064.14	300.62
Experiments in the manufacture of sugar, including an unexpended balance of \$58,364.76 from fiscal year 1889	do	25	840	1890	15,000.00	11,266.24	3,733.76
Quarantine stations	do	25	839	1890	500,000.00	311,025.81	(1)
Bureau of Animal Industry	do	25	837	1890	21,627.81	21,626.10	1.71
Silk culture, including \$1,627.81 from sale of raw silk	do	26	42	1890	20,000.00	19,652.17	347.83
Artesian wells	Apr. 4, 1890	26	282	1891	248,902.85	239,923.29	8,979.56
Salaries	July 14, 1890	26	284	1891	100,000.00	85,120.44	14,879.56
Collecting agricultural statistics	do	26	284	1891	40,000.00	36,428.36	3,571.64
Botanical investigations	do	26	284	1891			
	do	26	285	1891			
Investigating the history and habits of insects	do	26	285	1891	27,501.77	27,481.00	20.77
	July 28, 1892	27	296	1891			
Ornithology and mammalogy	do	26	285	1891	14,004.90	13,003.67	1,001.23
Pomological information	July 14, 1890	26	285	1891	5,000.00	4,983.88	16.12
Microscopical investigations	do	26	285	1891	5,000.00	3,281.90	1,718.10
Vegetable pathology	do	26	285	1891	15,000.00	14,995.75	4.25
Laboratory	do	26	285	1891	20,200.00	19,985.27	214.73
Forestry investigations	do	26	286	1891	10,000.00	9,785.99	214.01
Illustrations and engravings	do	26	286	1891	2,000.00	1,999.58	.42
Purchase and distribution of seeds	do	26	286	1891	105,400.00	105,090.94	309.06

Document and folding room.....	do	26	287	1	1891	2,000.00	1,995.53	4.47
Experimental garden and grounds	do	26	287	1	1891	28,500.00	28,396.41	103.59
Museum	do	26	287	1	1891	4,000.00	3,832.28	167.72
Furniture, cases, and repairs	do	26	287	1	1891	12,000.00	11,991.01	8.99
Library	Mar. 3, 1891	26	1049	1	1891	3,000.00	2,997.20	2.80
Postage	July 14, 1890	26	287	1	1891	5,000.00	4,893.00	167.00
Contingent expenses	do	26	287	1	1891	20,000.00	18,097.13	1,902.87
Office of Experiment Stations	do	26	287	1	1891	15,000.00	14,984.48	15.52
Experiments in the manufacture of sugar	do	26	288	1	1891	75,000.00	74,901.18	98.82
Irrigation investigations	Mar. 3, 1891	26	1050	1	1891	40,000.00	39,926.67	73.33
Quarantine stations	Sept. 30, 1890	26	525	1	1891	15,000.00	13,586.72	1,413.28
Bureau of Animal Industry, including an unexpended balance of \$188,974.69 from fiscal year 1890	July 14, 1890	26	288	1	1891	538,974.69	469,113.35	68,861.34
Silk culture, including \$565 from sale of raw silk	do	26	287	1	1891	20,565.00	19,526.33	1,038.67
Salaries	Mar. 3, 1891	26	285	1	1891	256,800.00	252,766.17	4,033.83
Collecting agricultural statistics	do	26	1045	1	1892	102,500.00	88,869.51	13,630.49
Botanical investigations	do	26	1046	1	1892	40,246.40	40,246.40	-----
Investigating the history and habits of insects	Aug. 23, 1894	28	440	1	1892	27,780.03	27,780.03	19.97
Ornithology and mammalogy	Mar. 3, 1891	26	1047	1	1892	15,000.00	14,688.00	312.00
Pomological information	do	26	1047	1	1892	5,000.00	4,955.27	14.73
Microscopical investigations	do	26	1047	1	1892	2,000.00	1,251.46	748.54
Vegetable pathology	do	26	1047	1	1892	15,076.47	15,076.47	-----
Laboratory	Aug. 23, 1894	28	440	1	1892	19,400.00	19,272.59	127.41
Fiber investigations	Mar. 3, 1891	26	1048	1	1892	10,000.00	8,017.44	1,982.56
Forestry investigations	do	26	1048	1	1892	15,056.85	15,056.85	-----
Illustrations and engravings	Mar. 3, 1893	27	660	1	1892	2,000.00	1,999.85	.15
Purchase and distribution of seeds	Mar. 3, 1891	26	1048	1	1892	105,400.00	104,920.35	479.65
Document and folding room	do	26	1049	1	1892	2,000.00	1,986.82	3.18
Experimental garden and grounds	do	26	1049	1	1892	28,622.53	28,536.67	85.86
Museum	Mar. 3, 1893	27	660	1	1892	4,000.00	3,909.17	90.83
Furniture, cases, and repairs	Mar. 3, 1891	26	1049	1	1892	10,000.00	9,996.55	3.45
Library	do	26	1049	1	1892	3,000.00	2,807.75	192.25
Postage	do	26	1049	1	1892	5,000.00	4,900.00	100.00
Contingent expenses	do	26	1049	1	1892	25,000.00	24,762.32	237.68
Office of Experiment Stations	do	26	1050	1	1892	20,000.00	19,989.47	10.53
Experiments in the manufacture of sugar	do	26	1050	1	1892	35,000.00	34,627.78	372.22
Quarantine stations	Mar. 18, 1892	27	7	1	1892	15,000.00	14,983.63	16.37
Bureau of Animal Industry	Mar. 3, 1891	26	1045	1	1892	650,000.00	649,980.91	19.09
Weather Bureau	Mar. 18, 1892	27	7	1	1892	889,753.50	861,840.83	27,912.67
Salaries	Mar. 3, 1891	26	1051	1	1893	256,800.00	253,896.30	2,903.70
Collecting agricultural statistics	July 5, 1892	27	74	1	1893	110,000.00	95,649.21	14,350.79
Botanical investigations and experiments	do	27	76	1	1893	27,500.00	27,451.55	48.45
Investigating the history and habits of insects	do	27	76	1	1893	17,800.00	17,290.80	509.20

1 Unexpended balance of \$188,974.69 carried to fiscal year 1891.

Statement of appropriations, disbursements, and unexpended balances for the Department of Agriculture, 1839-1897—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.		Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
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Investigations in ornithology and mammalogy.....	July 5, 1892	27	77	1893	\$15,000.00	\$14,947.77	\$52.23
Pomological information.....	do	27	77	1893	2,000.00	4,745.94	254.06
Microscopical investigations.....	do	27	77	1893	5,000.00	1,982.98	17.02
Vegetable pathology.....	do	27	77	1893	20,000.00	19,977.38	22.62
Laboratory.....	do	27	77	1893	19,400.00	18,002.59	1,397.41
Fiber investigations.....	do	27	78	1893	5,000.00	4,997.07	2.93
Forest investigations.....	do	27	78	1893	12,000.00	11,933.39	66.61
Illustrations and engravings.....	do	27	78	1893	2,000.00	1,905.73	93.27
Purchase and distribution of seeds.....	do	27	78	1893	135,400.00	134,908.27	491.73
Document and folding room.....	do	27	78	1893	2,000.00	1,623.55	376.45
Experimental garden and grounds.....	do	27	78	1893	28,500.00	28,115.09	384.91
Museum.....	do	27	79	1893	4,000.00	3,973.67	26.33
Furniture, cases, and repairs.....	do	27	79	1893	10,000.00	8,931.97	1,068.03
Library.....	do	27	79	1893	3,000.00	2,535.29	464.71
Postage.....	do	27	79	1893	5,000.00	3,705.00	1,295.00
Contingent expenses.....	do	27	79	1893	25,000.00	22,218.19	2,781.81
Experiments in the manufacture of sugar.....	do	27	80	1893	20,000.00	18,987.65	1,012.35
Quarantine investigations.....	do	27	80	1893	6,000.00	4,930.67	1,069.33
Experiments in the production of rainfall.....	do	27	76	1893	15,000.00	12,633.23	2,366.77
Bureau of Animal Industry.....	do	27	76	1893	10,000.00	4,979.59	5,020.41
Weather Bureau.....	do	27	79	1893	850,000.00	724,690.74	125,309.26
Salaries.....	do	27	81	1893	913,600.72	890,424.77	23,275.95
Collecting agricultural statistics.....	Mar. 3, 1893	27	734	1894	256,900.00	233,670.75	23,229.25
Botanical investigations and experiments.....	do	27	736	1894	110,000.00	91,080.20	18,919.80
Investigating the history and habits of insects.....	do	27	737	1894	30,000.00	24,401.40	5,598.60
Investigations in ornithology and mammalogy.....	do	27	737	1894	20,300.00	16,203.96	4,096.04
Pomological information.....	do	27	737	1894	17,500.00	17,450.00	50.00
Microscopical investigations.....	do	27	738	1894	5,000.00	4,248.99	751.01
Vegetable pathology.....	do	27	738	1894	2,000.00	1,117.55	882.45
Laboratory.....	do	27	738	1894	20,000.00	17,576.95	2,423.05
Fiber investigations.....	do	27	738	1894	21,900.00	10,426.79	11,473.21
Forestry investigations.....	do	27	738	1894	5,000.00	2,500.47	2,499.53
Illustrations and engravings.....	do	27	738	1894	20,000.00	19,995.96	4.04
Purchase and distribution of seeds.....	do	27	738	1894	135,400.00	119,719.76	15,680.24
Document and folding room.....	do	27	739	1894	2,000.00	1,662.81	337.19
Experimental garden and grounds.....	do	27	739	1894	31,500.00	26,615.86	4,883.14
Museum.....	do	27	739	1894	4,000.00	2,737.22	1,262.78
Furniture, cases, and repairs.....	do	27	739	1894	10,000.00	8,628.76	1,371.24
Library.....	do	27	739	1894	3,000.00	2,900.07	99.93

Postage.....	do	27	740	1	1894	5,000.00	1,375.00	3,625.00
Contingent expenses.....	do	27	740	1	1894	25,000.00	20,483.04	4,506.95
Experiment stations.....	do	27	740	1	1894	25,223.50	22,381.85	2,841.65
Inquiries relating to public roads.....	do	27	737	1	1894	10,000.00	9,997.39	7,002.61
Experiments in the manufacture of sugar.....	do	27	741	1	1894	20,107.33	9,451.80	10,655.53
Irrigation investigations.....	do	27	741	1	1894	6,000.00	5,475.92	524.08
Quarantine stations.....	do	27	740	1	1894	15,000.00	6,263.92	8,736.08
Quarantine stations.....	do	27	740	1	1894	850,000.00	496,111.34	353,888.66
Bureau of Animal Industry.....	do	27	740	1	1894	851,124.75	811,256.73	139,868.02
Weather Bureau.....	do	27	741	1	1894	243,600.00	204,589.72	39,010.28
Salaries.....	do	27	741	1	1895	110,000.00	93,243.78	16,750.22
Collecting agricultural statistics.....	do	27	741	1	1895	30,000.00	24,720.59	5,279.41
Botanical investigations and experiments.....	do	27	741	1	1895	20,300.00	15,969.02	4,330.98
Investigating the history and habits of insects.....	do	27	741	1	1895	17,500.00	13,982.43	3,517.57
Investigations in ornithology, etc.....	do	27	741	1	1895	5,000.00	4,895.36	104.64
Pomological information.....	do	27	741	1	1895	2,000.00	310.41	1,689.59
Microscopical investigations.....	do	27	741	1	1895	20,000.00	17,324.05	2,675.95
Vegetable pathological investigations, etc.....	do	27	741	1	1895	14,900.00	10,669.81	4,230.19
Laboratory.....	do	27	741	1	1895	5,000.00	3,455.21	1,544.79
Fiber investigations.....	do	27	741	1	1895	20,000.00	19,753.63	246.37
Report on forestry.....	do	27	741	1	1895	15,000.00	8,735.21	6,264.79
Illustrations and engravings.....	do	27	741	1	1895	165,400.00	111,992.01	53,407.99
Purchase and distribution of valuable seeds.....	do	27	741	1	1895	2,000.00	1,024.43	975.57
Document and folding room.....	do	27	741	1	1895	29,500.00	23,303.51	6,196.49
Experimental gardens and grounds.....	do	27	741	1	1895	3,000.00	1,839.73	1,110.27
Museum.....	do	27	741	1	1895	10,000.00	7,443.33	2,556.67
Furniture, cases, and repairs.....	do	27	741	1	1895	6,000.00	3,408.11	2,591.89
Library.....	do	27	741	1	1895	5,000.00	3,765.00	4,235.00
Postage.....	do	27	741	1	1895	5,000.00	8,243.82	1,756.18
Nutrition investigations.....	do	27	741	1	1895	10,000.00	18,796.52	6,209.48
Contingent expenses.....	do	27	741	1	1895	25,000.00	24,110.26	889.74
Agricultural experiment stations.....	do	27	741	1	1895	10,000.00	6,744.46	3,255.54
Inquiries relating to public roads.....	do	27	741	1	1895	10,000.00	5,103.87	4,896.13
Experiments in the manufacture of sugar.....	do	27	741	1	1895	6,000.00	3,164.27	2,835.73
Irrigation investigations.....	do	27	741	1	1895	12,000.00	5,450.98	6,549.02
Quarantine stations for neat cattle.....	do	27	741	1	1895	800,000.00	491,741.16	308,258.84
Bureau of Animal Industry.....	do	27	741	1	1895	878,438.84	820,691.94	485,884.62
Weather Bureau.....	do	27	741	1	1895	252,840.00	217,066.97	35,773.03
Salaries.....	do	27	741	1	1896	110,000.00	67,377.71	42,622.29
Collecting agricultural statistics.....	do	27	741	1	1896	10,000.00	9,332.18	6,367.82
Inquiries relating to public roads.....	do	27	741	1	1896	25,000.00	18,612.47	6,387.53
Botanical investigations and experiments.....	do	27	741	1	1896	20,000.00	17,022.68	2,977.32
Investigating the history and habits of insects.....	do	27	741	1	1896	17,500.00	14,805.89	2,694.11
Investigations in ornithology and mammalogy.....	do	27	741	1	1896	6,000.00	4,885.61	1,114.39
Pomological information.....	do	27	741	1	1896	2,000.00	.....	2,000.00
Microscopical investigations.....	do	27	741	1	1896	20,000.00	17,055.83	2,944.17
Vegetable physiology and pathology.....	do	27	741	1	1896	20,000.00	10,537.88	4,362.12
Laboratory.....	do	27	741	1	1896	14,900.00	10,537.88	4,362.12
Investigations in forestry.....	do	27	741	1	1896	15,000.00	16,626.51	8,373.49
Illustrations and engravings.....	do	27	741	1	1896	13,000.00	11,582.77	3,407.23
Materials document and folding room.....	do	27	741	1	1896	2,000.00	1,061.23	7,998.77
Experimental gardens and grounds.....	do	27	741	1	1896	29,500.00	22,149.18	7,350.82
Quarantine stations for neat cattle.....	do	27	741	1	1896	12,000.00	5,675.89	6,324.11

Statement of appropriations, disbursements, and unexpended balances for the Department of Agriculture, 1839-1897—Continued.

Purpose.	Date of appropriation act.	Reference to Statutes at Large.		Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
		Vol.	Page.				
Purchase and distribution of valuable seeds.	Mar. 2, 1895			1896	\$185,400.00	\$104,408.27	\$80,991.73
Experiments in the manufacture of sugar.	do			1896	10,000.00	1,510.94	8,489.06
Agricultural experiment stations.	do			1896	30,000.00	20,044.73	8,955.27
Irrigation investigations.	do			1896	15,000.00	4,558.55	10,441.45
Nutrition investigations.	do			1896	15,000.00	11,648.59	3,351.41
Investigations and experiments with grasses and forage plants.	do			1896	15,000.00	12,755.28	2,244.72
Investigations in relation to agricultural soils.	do			1896	15,000.00	12,330.27	2,669.73
Furniture, cases, and repairs.	do			1896	10,000.00	8,383.05	1,616.95
Postage.	do			1896	2,000.00	1,215.00	785.00
Museum.	do			1896	3,000.00	2,160.00	840.00
Fiber investigations.	do			1896	5,000.00	3,710.30	1,289.64
Library.	do			1896	6,000.00	3,412.67	2,587.33
Contingent expenses.	do			1896	25,000.00	14,783.47	10,216.53
Bureau of Animal Industry.	do			1896	800,000.00	543,077.23	256,922.77
Weather Bureau.	do			1896	885,610.00	751,332.85	134,277.17
Salaries.	Apr. 25, 1896			1897	313,860.00	262,648.39	21,211.61
Furniture, cases, and repairs.	do			1897	12,000.00	19,855.36	144.64
Library.	do			1897	7,000.00	8,288.20	1,711.80
Museum.	do			1897	7,000.00	8,782.98	3,217.02
Postage.	do			1897	3,000.00	4,685.44	2,314.56
Contingent expenses.	do			1897	3,000.00	2,889.60	110.40
Animal quarantine stations.	do			1897	25,000.00	1,730.00	1,270.00
Collecting agricultural statistics, etc.	do			1897	12,000.00	17,875.60	7,124.40
Botanical investigations and experiments.	do			1897	110,000.00	6,557.91	6,342.09
Entomological investigations.	do			1897	15,000.00	77,113.63	22,836.37
Vegetable pathological investigations.	do			1897	20,000.00	4,308.33	5,691.67
Biological investigations.	do			1897	17,500.00	12,618.33	2,381.67
Pomological investigations.	do			1897	6,000.00	17,775.16	2,224.84
Laboratory.	do			1897	12,400.00	17,413.75	1,926.25
Forestry investigations.	do			1897	20,000.00	16,305.32	55.00
Experimental gardens and grounds.	do			1897	6,000.00	4,784.45	1,194.68
Soil investigations.	do			1897	12,400.00	2,559.48	1,215.55
Grass and forage plant investigations.	do			1897	20,000.00	2,835.00	1,440.52
Fiber investigations.	do			1897	10,000.00	12,131.34	75.00
Agricultural Experiment Stations.	do			1897	30,000.00	18,977.32	7,868.66
Nutrition investigations.	do			1897	15,000.00	8,779.50	1,022.68
						8,605.00	560.50
						8,635.27	55.00
						4,136.00	1,894.73
						5,000.00	864.00
						30,000.00	1,897.92
						15,000.00	3,636.78

Public-road inquiries.....	do.....	1897	8,000.00	7,893.92	366.08
Publications.....	do.....	1897	70,000.00	41,247.27	8,752.73
	do.....	1897	150,000.00	14,062.38	937.62
Purchase and distribution of valuable seeds.....	do.....	1897	650,000.00	4,694.57	305.43
Salaries and expenses, Bureau of Animal Industry.....	do.....	1897	883,772.00	132,968.07	17,031.93
Weather Bureau.....	do.....	1897		571,774.46	77,025.54
	do.....	1897		1,100.00	100.00
	do.....	1897		786,605.14	97,166.86

RECAPITULATION.

Fiscal year.	Amount appro- priated.	Amount dis- bursed.	Amount unex- pended.	Fiscal year.	Amount appro- priated.	Amount dis- bursed.	Amount unex- pended.
1839.....	\$1,000.00	\$1,000.00		1864.....	\$199,770.00	\$199,270.00	\$10,500.00
1840.....				1865.....	112,304.05	112,196.55	107.50
1841.....				1866.....	167,787.82	167,787.82	
1842.....	1,000.00	1,000.00		1867.....	199,100.00	199,100.00	
1843.....				1868.....	279,020.00	277,094.94	
1844.....	2,000.00	2,000.00		1869.....	172,593.00	172,593.00	
1845.....	2,000.00	2,000.00		1870.....	156,440.00	151,596.93	
1846.....	3,000.00	3,000.00		1871.....	188,180.00	186,876.81	
1847.....	3,000.00	3,000.00		1872.....	197,070.00	195,977.25	
1848.....	4,500.00	4,500.00		1873.....	202,440.00	201,321.22	
1849.....	3,500.00	3,500.00		1874.....	257,690.00	233,765.78	
1850.....	5,500.00	5,500.00		1875.....	337,380.00	321,079.83	
1851.....	5,500.00	5,500.00		1876.....	249,120.00	198,843.64	
1852.....	5,000.00	5,000.00		1877.....	194,686.96	188,206.19	
1853.....	5,000.00	5,000.00		1878.....	196,640.00	197,634.94	
1854.....	10,000.00	10,000.00		1879.....	206,400.00	206,360.00	
1855.....	50,000.00	50,000.00		1880.....	199,500.00	198,361.72	
1856.....	30,000.00	30,000.00		1881.....	275,460.31	267,608.84	
1857.....	75,000.00	75,000.00		1882.....	363,011.05	354,452.39	
1858.....	63,500.00	63,157.25	\$342.75	1883.....	456,396.11	438,941.72	
1859.....	60,000.00	60,000.00		1884.....	141,641.13	143,618.09	
1860.....	40,000.00	40,000.00		1885.....	165,930.25	158,934.89	
1861.....	60,000.00	60,000.00		1886.....	167,973.22	159,196.11	
1862.....	64,000.00	63,704.31	295.79	1887.....	165,641.81	158,777.11	
1863.....	30,000.00	30,000.00		1888 ⁶	1,027,219.06	1,011,282.62	

¹ Including deficiency appropriation.

² Includes \$1,646.45 of the appropriation for reclamation of arid lands carried to the fiscal year 1882.

³ Includes \$65.26 of the appropriation for reclamation of arid lands, and \$3,530.85 of the appropriation for experiments in the manufacture of sugar, carried to the fiscal year 1883.

⁴ Includes \$7,056.13 of the appropriation for reclamation of arid lands, carried to the fiscal year 1884.

⁵ Includes \$93,192.27 of the appropriation for Bureau of Animal Industry, and \$2,970.82 of the appropriation for quarantine stations, carried to the fiscal year 1886.

⁶ For the fiscal year 1888 including the sum of \$8,000 appropriated for deficiencies in the appropriation for experiments in the manufacture of sugar for the fiscal years 1887 and 1888, of which \$7,927.50 was disbursed and \$72.50 remained unexpended.

Statement of appropriations, disbursements, and unexpended balances for the Department of Agriculture, 1889-1897—Continued.

RECAPITULATION—Continued.

Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.	Fiscal year.	Amount appropriated.	Amount disbursed.	Amount unexpended.
1889	1 \$1,134,480.60	\$1,033,580.22	\$100,890.38	1895	4 \$2,506,915.00	\$2,021,030.38	\$485,884.62
1890	1 1,170,139.11	1,071,823.62	98,315.49	1896	2,583,750.00	1,935,174.04	648,575.96
1891	1 1,372,049.21	1,286,277.36	105,771.85	1897	2,448,532.00	2,146,044.23	302,487.77
1892	1 2,303,655.75	2,253,262.29	50,393.46				
1893	2 540,060.72	2,355,430.25	184,630.47				
1894	2,603,855.58	1,977,469.28	626,386.30	Total	5 26,915,988.26	6 24,120,585.10	7 2,792,607.31

¹ Including deficiency appropriation.

² Includes \$12,923.25 of the appropriation for botanical investigations, and \$58,364.76 of the appropriation for experiments in the manufacture of sugar, carried to the fiscal year 1890.

³ Includes \$7,891.94 for statutory salaries of the year 1894.

⁴ This total is the amount actually appropriated for the various fiscal years, with the exception of \$37,604.70 appropriated July 13, 1868, to cover a number of expenditures made in previous years.

⁵ It does not include an aggregate sum of \$369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)

⁶ Does not include \$37,604.70 which was disbursed during several years, and covered by an appropriation of like amount, made July 13, 1868. (See note 5.)

⁷ Does not include an aggregate sum of \$369,344.48 reappropriated from the unexpended balances of several fiscal years. (See foregoing notes.)

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BULLETIN No. 4. *copy 2.*

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF PUBLICATIONS.

INDEX TO AUTHORS

WITH

TITLES OF THEIR PUBLICATIONS

APPEARING IN THE DOCUMENTS OF THE

U. S. DEPARTMENT OF AGRICULTURE,

1841 to 1897.

BY

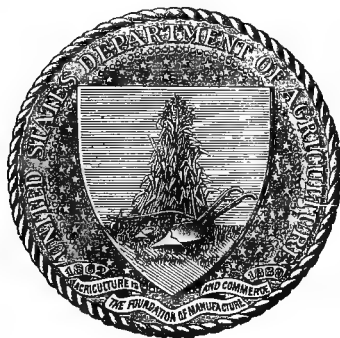
GEO. F. THOMPSON,

Assistant in Charge of Document Section, Division of Publications.

Under direction of

GEO. WM. HILL,

Chief of Division of Publications.



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1898.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF PUBLICATIONS,
Washington, D. C., June 27, 1898.

SIR: I have the honor to transmit for publication as Bulletin No. 4 of the Division of Publications an Index to Authors with Titles of their Publications Appearing in the Documents of the Department of Agriculture from 1841 to 1897, inclusive; the agricultural reports published previous to 1862 as a part of the Patent Office reports being considered for the purposes of this work as agricultural reports. This index was prepared by Mr. George F. Thompson while assistant in charge of the document section of this Division, but it is due to him to say that while it thus appears properly, as the title-page shows, under the direction of the chief of this Division, the greater part of the work was actually done by Mr. Thompson outside of the regular business hours, and both the suggestion and the plan of the work are largely his own.

The difficulties experienced by this Division during the past two years in its effort to answer all inquiries relating to the Department publications give assurance of the usefulness of the present publication and invite further effort in the direction of index work.

Very respectfully,

GEO. WM. HILL,
Chief.

HON. JAMES WILSON,
Secretary of Agriculture.

PREFACE.

In the Document Section, where requests for publications receive attention, a constant necessity exists for indexes of all series of the Department publications. This necessity is all the more apparent since the Division of Publications, on taking up the work of the Document Section, determined upon the policy of replying specifically to every communication received. These requests came in all manner of forms—sometimes by the number of the document, sometimes by its title, sometimes by the author's name, and sometimes by vague reference to the subject-matter. This catalogue of authors and their titles is the outgrowth of this necessity, but of course it only partially answers the requirements of complete reference books of the Department publications.

Although a conscientious effort has been made to include every author and his title, except the brief and unimportant letters appearing in the earlier agricultural reports, the hope can hardly be indulged that the catalogue is free from errors of omission; however, the hope is indulged that the errors are so few as not to impair its usefulness.

There is in the documents issued by this Department a vast amount of literature which bears no signature. There are many such articles in the annual reports and the reports of the Statistician. Of course such articles are not mentioned in an author's catalogue. Neither can proper credit be given here to a large amount of the work done on the Experiment Station Record and the seven volumes of *Insect Life*.

The plan of the work is to give a synopsis only where it is necessary to explain what is not clearly shown in the title. Sometimes such a title could not be framed, and in other instances there evidently was no effort to give the article a proper heading.

Previous to 1862 the agricultural reports were published as a part of the Patent Office Reports, but in this work, as in previous indexes, they are all considered as Agricultural Reports.

A key to the abbreviations used in the references is given. Articles which are without heads are supplied by myself, and are indicated by being inclosed in brackets.

GEO. F. THOMPSON.

LIST OF ABBREVIATIONS.

Ag.....	Agriculture.	Lib	Library.
Agros	Agrostology.	Misc	Miscellaneous.
B. A. I.	Bureau of Animal Industry.	Mo.....	Monthly.
Biol. Surv. .	Division of Biological Survey.	Mo. W. R.	Monthly Weather Review.
Bot	Botany.	N. A. Fauna	North American Fauna.
Chem.....	Division of Chemistry.	Nat	National.
Cont.....	Contributions.	n. s.	new series.
Cot	Cotton.	O. E. S.	Office of Experiment Stations.
Dis.....	Diseases.	O. and M.	Division of Ornithology and Mammalogy.
Doc	Document.	Path	Pathology.
Ent.....	Division of Entomology.	Pom	Pomology.
Ent. Com. . .	U. S. Entomological Commis- sion.	Pubs	Division of Publications.
E. S. R.	Experiment Station Record.	Rpt	Report.
Ex	Executive.	S	Senate.
F. B.	Farmers' Bulletin.	s	series
Fiber.....	Office of Fiber Investigations.	Soils	Division of Soils.
For	Forestry.	Spl.....	Special.
For. Mkts. .	Section of Foreign Markets.	Stat	Statistician.
H	House of Representatives.	t. s.	technical series.
Herb	Herbarium.	Unnum	Unnumbered.
I. L.	Insect Life.	Veg	Vegetable.
Inq	Inquiry.	W. B	Weather Bureau.
Irrig.....	Irrigation.	W. R	Weather Review
Jour. Mycol	Journal of Mycology.	Y. B.....	Yearbook.

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Glover, Townsend—Continued.

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Report of the Botanist. Ag. Rpt. 1880, pp. 375–386, illus.

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Report of the Botanist. Ag. Rpt. 1881, pp. 231–255, illus.

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BULLETIN No. 6.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

GRASSES AND FORAGE PLANTS

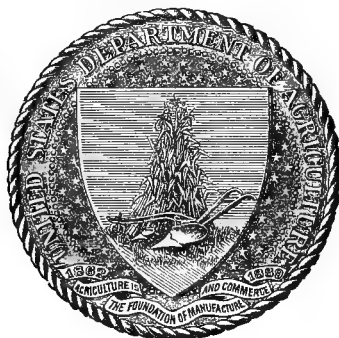
OF THE

DAKOTAS.

BY

THOMAS A. WILLIAMS.

PREPARED UNDER THE DIRECTION OF THE AGROSTOLOGIST.



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1897.

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY,
Washington, D. C., December 8, 1896.

SIR: I have the honor to transmit for publication as Bulletin No. 6 of this Division a report upon the grasses and forage plants and forage conditions of the Dakotas, based upon the work of the field agents in those States during the past season and upon the observations made by Mr. T. A. Williams, assistant in the Division, who has compiled the report. Mr. Williams has spent several years in South Dakota and become personally familiar with much of the territory covered by the report. The grass and forage problem of both Dakotas is an exceedingly important one, and this report can not fail to be of great interest not only to the farmers and landowners of those States, but also to those living throughout a large portion of the Northwest where similar conditions prevail. The work in North Dakota was chiefly performed by Mr. M. A. Brannon, who visited various parts of the State under a commission from the Department, and whose notes and observations are scattered through various parts of the report. Messrs. E. N. Wilcox and David Griffiths assisted in the work done in South Dakota, Mr. Wilcox working under a commission for two months and Mr. Griffiths for a shorter period.

The report is divided into three parts, the first embracing general notes upon the forage conditions in the Dakotas; this is followed by an alphabetical and descriptive list of the grasses and forage plants of those States, in which are embodied notes of economic interest; the third part, which is addressed to botanists, contains a classified list of the grasses and forage plants collected or observed by the field agents and by Mr. Williams, specifying localities and introducing occasional notes of botanical interest.

Respectfully,

F. LAMSON-SCRIBNER,

Agrostologist.

Hon. CHAS. W. DABNEY, Jr.,

Assistant Secretary.

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GRASSES AND FORAGE PLANTS OF THE DAKOTAS.

GENERAL NOTES ON THE FORAGE CONDITIONS IN THE DAKOTAS.¹

FEATURES OF THE FARMING AND STOCK-RAISING REGIONS.

The distinctively farming and stock-raising regions of the Dakotas are separated by more or less widely differing geological and meteorological conditions. In North Dakota the lands drained by the Red River of the North, the James River, and the Turtle Mountain slope of Mouse River are especially adapted to general agriculture. The rainfall, temperature, and character of the soil make this whole district peculiarly favorable to the growth of small grains.

These lands include about one-third of the entire State, and are given over chiefly to the growing of wheat, though other small grains are grown in large quantities. Nearly all varieties of flint corn and the early varieties of dent do well in this region, and many varieties which will not ripen seed on account of the shortness of the season can be profitably grown for forage. The straw from the fields of wheat and other small grains furnishes an almost inexhaustible supply of "roughness" for stock feeding. Root crops are easily grown, and are fed with the straw and the various by-products of small grain to a great advantage.

In South Dakota the lands adapted to general agriculture are those drained by the Sioux and James rivers, those of the Big Stone Basin, the lower Missouri Valley, and the rich valleys of the Black Hills region.

While, as with North Dakota, a considerable portion of these lands is devoted chiefly to wheat raising, many of them are well adapted to the growing of corn, flax, and other crops, and diversified farming is becoming more and more popular each year. Excellent crops of corn are grown in the lower Missouri Valley, the Sioux Valley, and the Big Stone Basin.

During the past few years a great many creameries have been established in various parts of the State, and this industry is being carried on with a high degree of success. The excellent quality of the native forage enables the creameries to send out such a fine product that Dakota butter is becoming famous and commands high prices in the markets.

¹ What is said here will apply to southwestern Minnesota, northwestern Nebraska, eastern Montana, and northeastern Wyoming.

THE NATIVE GRASSES.

As a consequence of the extensive breaking up of the virgin soil in the agricultural regions, many of the native grasses have been restricted to limited areas, which are usually too broken or too wet for cultivation. The principal native hay grasses are Big Blue-stem, Bushy Blue-stem, Switch-grass, Western Wheat-grass, Western Quack-grass, Slender Wheat-grass, Fowl Meadow-grass, Cord-grass, Wild-rye, the Blue-joints, and the various species of *Stipa*, while these grasses, with the Gramas, Buffalo-grass and Prairie June-grass, furnish most of the grazing.

With the exception of the Black Hills region of South Dakota, the immense tract of land west of the one hundred and first meridian to the Rocky Mountains is devoted almost exclusively to stock raising. In each of the Dakotas it includes two regions of very different character; one consisting of a broad rolling prairie known as the "range" and the other the famous Bad Lands. The latter region consists of a wide area of land broken up by excessive erosion into valleys and basins of various sizes alternating with hills or buttes, the sides of which are usually so steep and so unstable that few plants can grow upon them. The flat tops of the buttes and the bottoms of the valleys and basins are usually covered with a characteristic growth of vegetation of which the grasses form by far the greater part.

The principal grasses of the stock-raising regions are the Gramas, Buffalo-grass, Salt-grass, the Blue-joints, the Sand-grasses, Western Wheat-grass, Western Quack-grass, Needle-grass, and Feather Bunch-grass. Western Wheat-grass and Western Quack-grass furnish most of the hay, except in the moister bottoms, where the Blue-joints, Big Sand-grass, and the Cord-grasses are more or less abundant.

Overpasturing in times of drought is killing out many of the most valuable grasses here as well as elsewhere, and unless this practice is abandoned permanent injury will result to this, one of the most important of the natural resources of the Northwest.

The great value of this natural forage is evident when we look at the freight records of the various railroads and see the thousands of carloads of stock annually shipped from this region which are produced with no other feed than that growing naturally on the prairies. From Dickinson alone there were shipped 2,300 carloads off at cattle within ninety days during the summer and early autumn of 1895.

It is very important that every possible effort should be made to preserve the native grasses. They are naturally adapted to the conditions which prevail in the region, and it is quite improbable that introduced forms can be had to take their places satisfactorily, at least for years to come. "That some of the native forms flourish under conditions that would kill the common cultivated ones is seen by the situation in Stark County, N. Dak. At Dickinson, the Weather Bureau reports for 1895 show a rainfall of 11.75 inches. Of this amount 5.75 inches fell in June and July. The small precipitation of 0.64 inch in the three months

of August, September, and October favors the important process of curing on the ground. This enables thousands of cattle to live during the winter on the nutritious forage furnished by this method of curing the grasses which grow at this point" (Brannon). Such a climatic condition would soon destroy the ordinary cultivated grasses, but the native species have flourished under it for centuries, and there is no reason why they should not continue to do so and still yield plenty of forage, if properly handled.

THE IRRIGATION PROBLEM.

"The successful solution of the irrigation problem in the Dakotas would be of great value to the grazing as well as to the farming interests. In North Dakota an abundance of good artesian water can be secured by boring from 90 to 260 feet at many places in the eastern part of the State, but in the middle and western portions the artesian supply is to be found from 1,000 to 3,000 feet below the surface, and can not be certainly secured at even 3,000 feet in many places. There is considerable hope of irrigating successfully from surface wells from 30 to 90 feet deep which afford a large supply of good water. These wells may be operated by windmills at small expense" (Brannon). One of the most serious difficulties in the way of successful irrigation is a lack of sufficient capital on the part of the farm owners to put down good wells, build ditches and reservoirs, and keep up other necessary expenses until the farm is placed upon a paying basis. Another trouble is the lack of proper experience in handling the water after it is ready to turn on the land.

Experience has shown that many of the most valuable of the native grasses are very much benefited by a judicious application of even a small amount of water. As a rule there is sufficient rainfall to give the grasses a good start in the spring, and if enough water could be had to keep up a strong growth when the dry, hot summer weather comes on, an abundant forage crop would be assured.

In South Dakota, flowing wells can be had at varying depths throughout the James Valley, a portion of the Missouri Valley and of the Big Stone Basin. That excellent crops can be grown under irrigation from these wells is being proved by the State experiment station on the Hunter farm at Mellette, as well as by many private individuals in various parts of the artesian regions.

CONDITIONS IN THE ARTESIAN BASIN.

The following, taken from Mr. Wilcox's report, gives an account of the forage conditions in the artesian basin:

On the 17th of August I left Brookings County and went west into the artesian basin of the James River Valley, stopping first at Iroquois. The country from Brookings to Iroquois is a rolling prairie. The principal grasses are Little Blue-stem, Big Blue-stem, Western Wheat-grass, Porcupine-grass, Switch-grass, Big Sand-grass,

Wild-rye, and Spiked Muhlenberg's-grass. Along the artesian well drain at Iroquois *Sporobolus asperifolius*, Salt-grass, Western Wheat-grass, Wild-rye, Switch-grass, Cord-grass, Tall Grama, and very large specimens of Barnyard-grass abound. Blue Grama and Buffalo-grass are common on the prairies.

From Iroquois south to Vilas there is no perceptible difference in the flora.

From Vilas I went westward through Miner and Sanborn counties, and into north-western Aurora County. Near Artesian City, in Miner County, I crossed a large "Gumbo flat," on which little grew except Salt-grass, Saltbushes, and Western Sea-blight (*Suaeda depressa*). At Artesian City water is obtained at less than 100 feet, and the wells have been flowing for eight or nine years. The ordinary prairie grasses were common, and Slough-grass (*Beckmannia erucaformis*), was beginning to appear in the ditches and ponds.

From Artesian City westward the country grows drier and drier, except a strip of 10 or 12 miles on each side of the James River. Where I crossed the river near Forestburg, a herd of about 400 cattle had been pastured and were in fine condition.

The pasture was composed of native grasses. Big Sand-grass, Switch-grass, Tall Grama, Blue Grama, Western Wheat-grass, and Wild Vetch (*Hosackia purshiana*) grew in large quantities, but had all been fed close to the ground. The only plants which did not seem to have been eaten were *Cleome integrifolia* and several species of Golden Rod. There were acres of the *Cleome*, and the masses of rose purple flowers were a beautiful sight.

At Woonsocket several large artesian ponds had been drained and the vegetation cut for hay, but it did not seem to be of much value, as it was largely made up of species of *Bidens*, *Eleocharis*, and *Scirpus*. Barnyard-grass made the most valuable part of the hay.

At Letcher there were several large ponds fed by the artesian well. On the margins of these ponds were growing Reed-grass, Slough-grass, Barnyard-grass, Switch-grass, Long-leaved Prairie-grass, Cord-grass, and sparingly, Rice Cut-grass (*Homalocenchrus oryzoides*).

From Letcher westward Long-leaved Prairie-grass, Southern Poverty-grass, *Sporobolus brevifolius*, and *S. cryptandrus* became more and more common. Buffalo-grass grew in considerable quantity; Wild Crab-grass was occasionally seen, and also the low-growing Cacti (*Mamillaria vivipara*, *M. missouriensis*, and *Opuntia fragilis*). The grasses seemed to gradually decrease in size, and a relatively larger amount of seed was produced by each species than farther eastward, although, owing to dry weather, much of the seed did not mature.

Northern Aurora County is in the western part of the James River Valley close to the Wessington Hills, which divide the small streams flowing into the James River from those flowing into the Missouri. For nine or ten years the rainfall here has been scanty and much of the land has, to use the local expression, "gone back," i. e., been broken up and cultivated for two or three years, then deserted and allowed to grow up to grass and weeds. This would make better hay-land if the Russian Thistle and Gum Weed (*Grindelia squarrosa*) were not present in such large quantities. The latter weed is spreading over the whole country, prairies, pastures, and all uncultivated land. The woody, sticky stems cause considerable trouble in haying season, but are worst in the pastures, where the resinous exudation sticks to the faces of cattle, horses, and sheep, causing eyes and nostrils to become inflamed and sore. The plant has the one redeeming feature of being good to burn, and is being collected in considerable quantity for winter fuel.

The Wessington Hills have an elevation of two or three hundred feet above the surrounding country. There were formerly many small lakes among these hills, but they are now nearly all dry. The Firesteel Creek heads in the Wessington Hills, and runs southeast about 50 miles, where it enters the James River near Mitchell. Along the banks of the Firesteel grow *Petalostemon violaceus*, *P. candidus*, *P. multiflorus*, *Amorpha canescens*, *A. microphylla*, *Psoralea argophylla*, *P. esculenta*, *Astragalus caryocarpus*, *A. plattensis*, *A. adsurgens*, *A. racemosus*, *A. lotiflorus*, *A. missouriensis*, *A. canadensis*, *Oxytropis lambertii*, *Glycyrrhiza lepidota*, and such grasses as Big Blue-stem,

Little Blue-stem, Bushy Blue-stem, Tall Grama, Blue Grama, Long-leaved Prairie-grass, Southern Poverty-grass, Switch-grass, Western Beard-grass, Wild-rye, Lyme-grass, Western Wheat-grass, Spiked Muhlenberg's-grass, Mexican Wood-grass, Slender Wheat-grass, Buffalo-grass, Cord-grass, Big Sand-grass, Montana Sand-grass, *Sporobolus brevifolius*, *Panicum depauperatum*, and *Homalocenchrus virginicus*.

In the dry sloughs of the prairie, grow Blue-joint, Reed Canary-grass, Cord-grass, and Switch-grass.

In the "burn outs," "blow outs," or "buffalo wallows" grow *Sporobolus cryptandrus*, *Leptochloa fascicularis*, Salt-grass, Long-leaved Prairie-grass, Buffalo-grass, *Atriplex argenteum*, *Plantago patagonica*, vars. *gnaphalioides* and *nuda*, *P. pusilla*, and *Marsilea vestita*. As the "buffalo wallows" require much work and time to make them productive when cultivated, they are usually pastured. All the above-mentioned plants are eaten by stock.

One of the farmers here had about a quarter of an acre of Smooth Brome-grass grown from seed sent out for trial by the State experiment station. The grass was growing well and maturing a good crop of seed. In the town of Plankinton was a small field of Timothy and Red Clover which had been watered thoroughly during the dry weather. When I saw it about the middle of August, one fine crop of early hay had been cut and a second, heavier crop, was just being gathered.

The artesian ponds at Plankinton contained *Typha latifolia*, *Sparganium eurycarpum*, *Scirpus robustus*, *S. lacustris*, *S. fluviatilis*, *Leptochloa fascicularis*, *Beckmannia erucaeformis*, *Calamagrostis canadensis*, and *Spartina cynosuroides*, while on the margins grew Big Blue-stem, Barnyard-grass, Switch-grass, Long-leaved Prairie-grass, Wild-rye, Tall Grama, Western Wheat-grass, and Squirrel-tail-grass.

In concluding this part of my report I might say that the most interesting things which I have observed were the climatic differences which occurred in traveling a distance of only 100 miles, the corresponding effects of these changes on the flora of the regions visited, and, in the drier parts of the State, the marked influence of irrigation on all kinds of vegetation.

In the eastern part of the State good crops are nearly always secured, but owing to the low price of grain, farmers are largely going into dairying. In this section it costs from 75 cents to \$1.25 per month to pasture cattle and horses. The winters are nearly always snowy and stock must be stabled and fed for a long time.

In northern Aurora County, where for some time there has been so little rain that farmers have secured a good crop only once in four or five years unless they irrigated, horses and cattle are pastured from May to November for \$2 per head. There is very little snow in winter, and cattle and horses live upon the open prairies. I saw numbers of young well-bred horses which were in fine condition and yet had been fed neither hay nor grain, nor had they been stabled for over two years. Cattle were fatter than any I saw in Iowa or Illinois, although the prairie grass looked scorched and dry.

In general, irrigated plants are larger, they grow and remain green for a longer period of time, and relatively they produce much less seed in proportion to the stems and leaves than plants of the same species and locality under natural conditions. There is a belt of green vegetation around artesian ponds and ditches long after the plants on the prairies are dry and yellow.

I gathered mature seeds of *Beckmannia erucaeformis* at Brookings before the middle of July, and four weeks later at the artesian well at Plankinton, this grass was seen in bloom.

The following forage plants are common about artesian wells: *Typha latifolia*, *Sparganium eurycarpum*, *Scirpus lacustris*, *Scirpus fluviatilis*, *Scirpus robustus*, *Carex douglasii*, *Carex straminea*, *Spartina cynosuroides*, *Phragmites vulgaris*, *Distichlis spicata stricta*, *Leptochloa fascicularis*, *Sporobolus longifolius*, *Panicum virgatum*, *Panicum crus-galli*, *Hordeum jubatum*, *Chaetochloa glauca*.

Until recent years there was little need in either of the Dakotas of growing tame grasses, and, as is always the case, many of the first

attempts in this direction met with failure or only indifferent success. However, as the farmers are becoming more acquainted with the peculiarities of soil and climate existing in this region, better results are being obtained, and at the present time in many parts of both North Dakota and South Dakota may be found excellent pastures and meadows of tame grasses. In the rich bottom lands in the older settled regions Timothy, Red-top, Alsike, Red Clover, White Clover, Smooth Brome-grass, Blue-grass, and several of the fescues give paying crops. Millet is extensively grown in all the farming communities, and such recent introductions as Kaffir Corn, Lupines, and Sand-vetch seem likely to assume an important place among the forage crops of this region, already so bountifully supplied by nature with the "grasses of the field."

Wherever irrigation is practiced there is no difficulty in getting paying crops of such grasses as Timothy and Red-top, and it is quite certain that many other forage plants can be successfully grown in the artesian regions when the vast underground water supply can be utilized.

GRASSES AND OTHER PLANTS OF THE DAKOTAS WHICH ARE OR MAY BE OF IMPORTANCE AS FORAGE.

Agropyron.

Of the several species of *Agropyron*, or Wheat-grasses, growing in the Dakotas, Western Wheat-grass (*Agropyron spicatum*) is the most common and the most valuable. Western Quack-grass (*A. pseudorepens*) and Slender Wheat-grass (*A. tenerum*) (fig. 1) are also valuable, but are less abundant in the dry regions than Western Wheat-grass. These *Agropyrons* are plentiful both on the "range" and in the agricultural regions, and are highly valued for both hay and pasturage. They grow voluntarily on old plowings, and instead of attempting to destroy the plants, which would be difficult on account of the numerous underground stems, or rhizomes, many farmers prefer to leave such lands for meadows. The yield of hay is usually much better than on the unbroken prairie. In favorable seasons three tons per acre are often obtained from these meadows. Wheat-grass hay is one of the most nutritious grown in the Northwest. Under ordinary circumstances a Wheat-grass meadow will not give a good crop every year; usually the yield is light the third year. Many farmers overcome this trouble by harrowing or disking the meadow, which breaks up the underground stems of the grass, and a fine growth of new shoots is the result. The Wheat-grasses cure on the ground in the grazing regions and furnish a large amount of very nutritious forage during the winter. From the middle of July there is little rain in the western cattle districts, and these grasses mature early and are the chief forage plants on which thrive the choice beeves, which command fancy prices in the eastern markets. They have few equals among the grasses of the western prairies in the quantity or quality of forage produced, and should be cultivated and improved as much as possible.

Agropyron caninum. (See Bearded Wheat-grass.)

Agropyron divergens. (See Bunch Wheat-grass.)

Agropyron pseudorepens. (See Western Quack-grass and *Agropyron*.)

Agropyron richardsoni. (See Bearded Wheat-grass.)

Agropyron spicatum. (See *Agropyron*.)

Agropyron tenerum. (See *Agropyron* and Slender Wheat-grass.)

Agrostis scabra. (See Tickle-grass.)

Alfalfa (*Medicago sativa*).

This plant is grown in many parts of both Dakotas, but generally with indifferent success. Where irrigation is possible, better results are had. No difficulty is experienced in getting a good stand, but too often the season is unfavorable for the rapid development so necessary to the successful growing of this crop. The plants turn yellow and the first cutting is light. Where the field can be irrigated immediately on the taking off of the first crop, this trouble is not so serious. The plants are often badly affected by a fungous disease which causes the leaves to fall early, and thus much of the most valuable part of the forage is lost.

Alopecurus geniculatus fulvus. (See Wild Water Foxtail.)

Alsike (*Trifolium hybridum*).

This clover occurs in door yards, along roadsides, and occasionally in fields in the valleys of the Red, James, and Sioux rivers. It does well in the eastern part of South Dakota, and Professor Brannon, speaking of it in the Red River Valley in North Dakota, says "it seems to be quite hardy and would no doubt do well sown with Timothy, Orchard-grass, or Kentucky Blue-grass."

American Vetch (*Vicia americana*).

More or less abundant in the eastern part of both States, where it grows in moist places. "It is relished by all kinds of stock and furnishes considerable food," which is "considered very fattening."

Andropogon hallii. (See Colorado Sand-grass.)

Andropogon nutans. (See Bushy Blue-stem.)

Andropogon provincialis. (See Big Blue-stem.)

Andropogon scoparius. (See Little Blue-stem.)

Aristida fascicularis. (See Western Beard-grass.)

Arrhenatherum elatius. (See Tall Oat-grass.)

Astragalus.

There are a large number of species belonging to this genus found in the Northwest. Some of them are readily eaten by stock and are highly prized by stockmen; others are so bitter and unpalatable that few animals will touch them, while still others are thought to be injurious.

Astragalus adsurgens. (See fig. 6.)

This species is said to be eaten readily by stock, particularly on the "range," when grasses are dry and short. This, and other small-fruited species, are known as Milk Vetch.

Astragalus bisulcatus.

One of the strong smelling species. "The plant has a rather rank taste when young, but loses this as it becomes mature, when stock readily eat both stems and leaves" (Brannon).



FIG. 1.—Slender Wheat-grass (*Agropyron tenerum*).

Astragalus caryocarpus. (See Buffalo Pea.)

Astragalus canadensis.

A coarse-growing species seldom eaten by stock of any kind.

Astragalus flexuosus.

In this species the stems become woody so early that it has little, if any, value as a forage plant.

Astragalus hypoglottis.

This small Milk Vetch is very abundant on our Northwestern prairies. It is relished by stock and furnishes no inconsiderable amount of forage in many localities. No good common name has as yet been given to this species. Bristly-fruited Milk Vetch would suit it very well.



FIG. 2.—Barnyard-grass (*Panicum crus-galli*).

artesian wells. It seems probable that it could be cultivated to advantage in the artesian basin, and it should be given an extended trial (fig. 2).

Bearded Wheat-grass (*Agropyron richardsoni* and *A. caninum*).

These species are much more valuable for hay than for grazing, as they fruit early and produce very little growth during the remainder of the season.

Beckmannia erucæformis. (See Slough-grass.)

Beckwith's Clover (*Trifolium beckwithii*).

This pretty little clover is quite abundant in the upper Sioux Valley, but only in a rather limited area, and it has not been reported from any other locality in the middle Northwest. It grows in rather moist prairie meadows and along the margins of swales. In the vicinity of Brookings, S. Dak., it is very plentiful and forms an important element in the native pasturage. It may prove valuable under cultivation.

Big Blue-stem (*Andropogon provincialis*).

This is the most common blue-stem in this region. It is everywhere regarded as one

Astragalus plattensis. (See Buffalo Pea.)

Atriplex spp. (See Salt-bushes.)

Avena fatua. (See Wild-oats.)

Avena americana. (See Native Meadow Oat-grass.)

Barnyard-grass (*Panicum crus-galli*).

Found more or less abundantly throughout the Northwest in fields and waste places. It makes an immense growth in rich moist soils. All kinds of stock eat it readily, either in the green state or as hay. The hay is coarse and should be cut before the stems become woody. It is becoming very abundant on waste irrigated lands, where it often reaches a height of from 4 to 6 feet. At Redfield, Iroquois, Letcher, and elsewhere in the James Valley it is one of the most conspicuous plants along ditches and about ponds fed by

of the most valuable of the native grasses. Though it occurs in greater or less abundance on the prairies, it reaches its best development in the moist bottom lands along streams and in the lake regions. In the Sioux Valley, Red River Valley, Big Stone Basin, and lower Missouri Valley this is the most highly prized hay grass of all the native species. It is becoming more abundant as the country is settled up, and prairie fires are better controlled and the meadows given better care.

Big Sand-grass (*Calamovilfa longifolia*).

This is one of the most widely distributed grasses on the Northwest prairies. It prefers sandy soils in rather moist localities. It is one of the most conspicuous grasses of the moist runs and sandy basins of the Bad Lands, and affords a considerable amount of coarse hay. Its rigid leaves and strong-growing rootstocks make it an excellent sand binder.

Black Grama (*Bouteloua hirsuta*).

This is often found in company with Blue Grama, but is much less common and of less importance agriculturally.

Blow-out grass (*Muhlenbergia pungens*).

This grass is apparently rare, and is of little value for forage, as stock seldom eat it, on account of its rigid, pointed leaves. It grows about "blow-outs," in dry, sandy soil, and is of considerable value as a sand binder.

Blue-eyed grass (*Sisyrinchium angustifolium*).

This is a small grass-like plant belonging to the Iris family, and is quite abundant in the eastern part of both States. It forms clusters of leaves and stems, which are liked by all kinds of stock.

Blue Grama (*Bouteloua oligostachya*).

This is the most common grama in the Northwest. It is very abundant on the ranges, and ranks among the most important plants for grazing purposes in those regions. It "sun cures," and not only serves for forage in summer and fall, but continues to be one of the main food supplies in winter. Together with Black Grama, it is often called "Buffalo-grass." Cattlemen hold both grasses in high esteem (fig. 3).

Blue-joint (*Calamagrostis canadensis* and *C. scribneri*).

The Blue-joints are abundant throughout in moist meadows and pastures. They produce an excellent growth of root leaves, and hence are heavy yielders. The hay, though often coarse, is almost equal to Timothy in nutritive qualities.

Bog-rush (*Juncus* spp.).

Several species of Bog-rush occur in greater or less abundance. All are eaten by stock to some extent, and they usually form a small part of the hay obtained from low boggy places.

Bouteloua hirsuta. (See Black Grama.)

Bouteloua oligostachya. (See Blue Grama.)

Bouteloua racemosa. (See Tall Grama.)



FIG. 3.—Blue Grama (*Bouteloua oligostachya*).

Bromus ciliatus. (See Swamp-chess.)

Bromus inermis. (See Smooth Brome-grass.)

Bromus kalmii. (See Kalm's Chess.)

Broom-corn Millet (*Panicum miliaceum*).

This millet is quite extensively cultivated throughout the Northwest and is especially valuable because of the short season which it needs to reach maturity and because of the large yield of seed. As a hay plant it is much less valuable than the common millet. The seed has been used to very good advantage for fattening hogs and feeding other farm animals. In some parts of the Northwest it is known as Hog Millet. Enormous yields of seed have been obtained in the eastern parts of the Dakotas. The seed is fed to best advantage when crushed or ground and it is often soaked for hogs. Though it is not the equal of corn as a food for fattening animals it may, under certain circumstances, very well take the place of it. The plant stands drouth well, grows rapidly, and makes an excellent catch crop.

Buffalo Pea (*Astragalus caryocarpus* and *A. plattensis*).

These plants are more or less abundant on dry prairies throughout the whole Northwest. *Astragalus caryocarpus* is by far the commonest of the Buffalo Peas.

It is eaten by cattle and sheep, and the latter are said to be particularly fond of the fleshy plum-like peapods. These pods are also sometimes used as an article of human diet.



FIG. 4.—Buffalo-grass (*Bulbils dactyloides*).

Buffalo-grass (*Bulbils dactyloides*).

This famous range grass is still quite abundant in the regions west of the James Valley in both Dakotas. It is by no means as rare as most people suppose, being frequently overlooked on account of its similarity to certain of the grama-grasses and because it seldom fruits in any great quantity. The dense mats formed by its curly leaves and creeping stems may be distinguished from the surrounding vegetation on account of their paler color. Stock are very fond of this grass, and especially in winter prefer it to any other native forage (fig. 4).

Bunch Wheat-grass (*Agropyron divergens*).

“A bunch grass of the Bad Lands. It furnishes a large amount of excellent forage. The leaves remain green long after the flowering season and are much relished by all kinds of stock” (Brannon).

Bushy Blue-stem (*Andropogon nutans*).

This grass is scarcely less valuable than Big Blue-stem. It thrives on rather drier soil than that species, and, like it, is becoming more abundant every year.

Calamovilfa longifolia. (See Big Sand-grass.)

Calamagrostis americana.

This grass is very common in moist meadows, particularly where the soil is sandy, and “affords a large amount of excellent hay,” if cut in proper season. It is called “Sand-grass” and “Yellow-top” in some parts of the Northwest.

Calamagrostis canadensis. (See Blue-joint.)

Calamagrostis montanensis. (See Montana Sand-grass.)

Calamagrostis scribneri. (See Blue-joint.)

Carex spp. (*See Sedges.*)

Cenchrus tribuloides. (*See Sand-bur.*)

Chaetochloa glauca. (*See Yellow Foxtail.*)

Chaetochloa italica. (*See Millet.*)

Chaetochloa viridis. (*See Green Foxtail.*)

Colorado Sand-grass (*Andropogon hallii*).

This is very much like Big Blue-stem in appearance, but is probably less valuable for forage. It grows in sandy soils, and, because of its stout rootstocks, which are often several feet in length, it is a good sand binder.

Cord-grass (*Spartina cynosuroides*).

A common grass in sloughs and wet places throughout the Northwest. It, together with certain rushes and sedges, makes up the greater part of the early hay cut in this region. The hay is coarse but nutritious, and is relished by stock. "The stems contain considerable sugar, and are eaten readily by stock" if the hay has been cut before they become too tough and woody. It is extensively used as a thatch for roofs of sheds and stables, and also for fuel. When made into firm "twists," it makes a fair substitute for wood, and often is one of the principal sources of warmth for people who through lack of funds or in times of scarcity can not get a sufficient supply of wood and coal.

Cow Pea (*Vigna catjang*).

Occasional under cultivation. At Brookings and Mellette, S. Dak., this plant made an excellent growth the past season, but failed to ripen seeds. It may prove to be a good plant for soiling purposes.

Cyperus spp.

There are several species of this genus which enter more or less into the native forage supply of this region. They grow in wet soil, and seldom occur in very great quantity. *Cyperus erythrorhizos* and *C. speciosus* are the most important species as far as the forage question is concerned.

Cyperus schweinitzii.

This sand-loving cyperus is probably of little importance as a forage plant, except, perhaps, in the sandy bottoms along streams or lakes. "Its chief use is for holding the sand and preventing the drifting, which is excessive in some localities" (Brannon).

Dactylis glomerata. (*See Orchard-grass.*)

Dalea alopecuroides.

This leguminous plant is quite abundant in the lower Missouri Valley region. It prefers dry sandy soils, and yields considerable forage, which stock eat quite readily. In some localities it is highly prized by stockmen.

Deschampsia cæspitosa. (*See Tufted Hair-grass.*)

Desmodium canadense.

This is a common plant in low pastures and along the borders of woods. It grows 3 to 5 feet high, and produces a large number of leaves, which are relished by cattle and sheep. It goes by the name of "Meadow trefoil" or "Stick-seed."

Distichlis spicata stricta. (*See Salt-grass.*)

Early Bunch-grass (*Eatonia obtusata*).

This is an excellent pasture grass because of its earliness and of the fine quality of the forage produced. It is not often present in any great quantity, however, but is most abundant in the moister regions, where it is much prized as an early pasture grass.

Eatonia nitida. (*See Short-leaved Eatonia.*)

Eatonia pennsylvanica.

This grass flourishes in moist meadows and open woods, but forms too small a part of the forage to be of much importance for either pasturage or hay. Like early bunch grass, however, the forage is of excellent quality.

Eleocharis spp. (*See Spike-rush.*)

Elymus canadensis. (*See Wild-rye.*)

Elymus macounii. (*Macoun's Wild-rye.*)

Elymus virginicus. (*See Lyme-grass.*)

Eragrostis major. (*See Stink-grass.*)

Eragrostis purshii. (*See Southern Spear-grass.*)

Eriocoma cuspidata. (*See Indian Millet.*)

Eurotia lanata. (*See Winter Fat.*)

False Buffalo-grass (*Munroa squarrosa*).

A low-growing grass of dry, sandy soils. Stock seldom eat it on account of its harsh stems and rigid, pointed leaves. It is said that the agricultural ants collect the seeds of this grass for their store of winter food.

False Redtop. (*See Poa flava and Panicum virgatum.*)

Feather Bunch-grass (*Stipa viridula*).

Very abundant in dry, sandy soils, furnishing a large amount of forage. The "spears" of this grass are not so injurious as are those of the other two species of *Stipa* occurring in the Dakotas.

Festuca elatior. (*See Tall Fescue.*)

Festuca elatior pratensis. (*See Meadow Fescue.*)

Festuca octoflora. (*See Slender Fescue.*)

Festuca ovina. (*See Sheep's Fescue.*)

Fine-topped Salt-grass (*Sporobolus asperifolius*).

More or less abundant in saline soils in the western part of the Dakotas. Cattle are not very fond of it, but will eat it when other forage is scarce, and as it thrives on soils that will grow but few other grasses it may be valuable in some localities.

Floating Meadow Foxtail. (*See Wild Water Foxtail.*)

Fowl Meadow-grass (*Poa flava*).

This is one of the most valuable of the native species of *Poa*. It occurs in both dry and moist soils, but reaches its best development in the latter. In many localities in the eastern part of both States it furnishes a large portion of the forage. It is particularly valuable on lowland meadows that are occasionally overflowed. In the Sioux Valley at Brookings, S. Dak., this grass sometimes furnishes 50 per cent of the hay cut from the meadows near the river.

Glyceria airoides.

Grows in old lake beds and in sandy alkaline basins. It is most abundant in the Bad Lands. In the latter region it often furnishes considerable forage.

Glyceria aquatica. (*See Reed Meadow-grass.*)

Glyceria fluitans. (*Floating Manna-grass.*)

Glyceria nervata. (*See Nerved Manna-grass.*)

Great Bulrush (*Scirpus lacustris*).

Though sometimes eaten by stock, this plant is of little importance for forage, unless perhaps, in very marshy land.

Green Foxtail (*Chætochloa viridis*).

A weedy grass, becoming more or less abundant in cultivated lands. "It grows luxuriantly on rich ground, and may be used for hay with profit if cut early." Screenings composed largely of the seeds of this and other Foxtails are often fed to calves and poultry with most excellent results.

Hairy Vetch (*Vicia villosa*). (*See Sand Vetch.*)

Holy Grass. (*See Sweet-grass.*)

Hordeum jubatum. (*See Squirrel-tail.*)

Hordeum nodosum. (*See Wild Barley.*)

Hosackia purshiana. (*See Wild Vetch.*)

Hungarian Grass (*Chætochloa italica germanica*).
(*See Millet.*)

Indian Millet (*Eriocoma cuspidata*).

This is one of the bunch-grasses of the Bad Lands, where it is regarded as a good forage plant. After fruiting, the stems and leaves become hard and woody and then are not much eaten by stock unless better forage is scarce. However, stock are very fond of the ripened seeds, which are said to be very nourishing. It usually occurs in sterile, broken soil where but few other grasses will grow.

Indian Rice (*Zizania aquatica*).

This grass is quite plentiful in running water throughout the region east of the Missouri River. It is often so abundant in the Sioux River as to cover the entire bed of the stream for long distances. All kinds of stock eat it with relish, and cattle and horses will wade out into the water and bite off the grass down to the surface of the water. In dry seasons when the water is low the grass is cut and used for fodder. The seeds are a favorite article of food of the Indians, and are also often used by the white settlers. During their fall migrations the wild fowl come to the rice-filled streams by thousands, for they are very fond of the seeds of this grass. It is a valuable plant for use in seeding down the waters of game preserves (fig. 5).

Juncus spp. (*See Bog-rush.*)

Kaffir Corn (*Andropogon sorghum* var.).

This forage plant has received considerable attention in the Dakotas during the last few years. The chief obstacles in the way of its culture have been the cold, often late springs, which kept the plants from making sufficient growth to allow the cultivation necessary to keep the weeds in check, and the short seasons, which do not allow many of the varieties to ripen seed. However, many farmers have succeeded in growing the hardier varieties with excellent results, and it is not unlikely that Kaffir Corn may soon become one of the principal

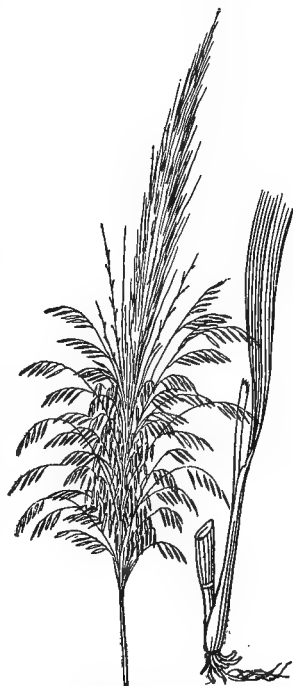


FIG. 5.—Indian Rice (*Zizania aquatica*).

sources of the supply of coarse forage for this region. Both red and white varieties were grown very successfully on the Hunter farm at Mellette, S. Dak., the past season, as also on the station farm at Brookings, and farmers from various parts of both States give very encouraging reports of their attempts to grow this crop.

Kalm's Chess (*Bromus kalmii*).

Usually too rare to be of much importance as a forage plant. It grows in dry, open woodlands and, so far, has been found to be most abundant in the Turtle Mountain region.

Kentucky Blue-grass (*Poa pratensis*).

This grass is pretty generally distributed over the eastern portion of both Dakotas, either in the wild or in the cultivated state. "It makes the best development in rich moist meadow lands, where it yields well in both hay and pasturage. It matures early and does well when mixed with other grasses, and hence is valued for upland pastures." It is an excellent grass for use in reseeding worn-out places in the native pastures. The dry weather of midsummer often causes it to dry up considerably, but stock like it even in that condition. It starts early and also makes a good growth after the September rains, and hence forms an important element in the forage of the season.

Koeleria cristata. (See Prairie June-grass.)

Lathyrus palustris. (See Native Meadow Pea.)

Lathyrus venosus.

A very pretty native pea growing on shaded banks, said to be "eaten greedily by cattle and hogs."

Little Blue-stem (*Andropogon scoparius*).

This blue-stem is found throughout the Northwest on dry prairies and hillsides. Early in the season it is eaten by stock, but it soon becomes so tough and woody that the animals will not eat it unless forced to do so. The dense clusters of woody stems are very difficult to cut, and will almost ruin an ordinary mower if much of the grass is present in the hay meadow. In the Bad Land "basins" it is the most conspicuous grass seen, and forms very dense bunches of tough, wiry stems seldom eaten by cattle or horses.

Long-leaved Prairie-grass (*Sporobolus longifolius*).

More or less abundant in rather dry, sandy meadows and along hillsides and edges of fields. It yields a large amount of forage, which is eaten by stock while young and fresh or when properly cut and cured. Late in the season it develops so much woody tissue in the stems and leaves that neither cattle nor horses will eat it unless forage is scarce. It is possible that the plant could be utilized in the manufacture of paper, mats, etc., as the leaves are long and contain such an abundance of fibrous tissue. The grass flourishes in the vicinity of the waste water from artesian wells.

Lyme-grass (*Elymus virginicus*).

More or less abundant in open woods and dry meadows. It is an excellent grass for early pasturage, and also furnishes a considerable amount of hay in certain localities. It is frequently badly affected with ergot, and then the hay is injurious to stock unless cut early. In the lower Sioux and Missouri valleys this grass, together with Wild-rye (*Elymus canadensis*), furnishes much of the forage in woodland pastures.

Meadow Fescue (*Festuca elatior pratensis*).

This fescue has given better results than any other large fescue tried in the Northwest. It thrives best on rich, moist bottom lands, and is an excellent grass for mixtures for permanent meadows and pastures. It does not succeed well on dry upland or sandy soils, but can be used to advantage in seeding down sloughs or lake beds that have been drained.

Meadow-rush (*Scirpus atrovirens* and var. *pallidus*).

Wet sloughs. It is readily eaten by stock and occasionally occurs in considerable quantity in "Slough-grass hay."

Meadow Trefoil (See *Desmodium canadense*.)**Medicago sativa**. (See Alfalfa.)**Melica hallii**.

A fescue-like grass found on dry rolling prairies. Probably of little importance as a forage.

Melilotus alba. (See White Sweet Clover.)**Mesquite**. (See *Bouteloua* spp.)**Mexican Wood-grass** (*Muhlenbergia mexicana*).

A common grass in moist soil in open woods and thickets. It yields considerable forage, which is very nutritious, and in certain localities is of some importance in woodland pastures.

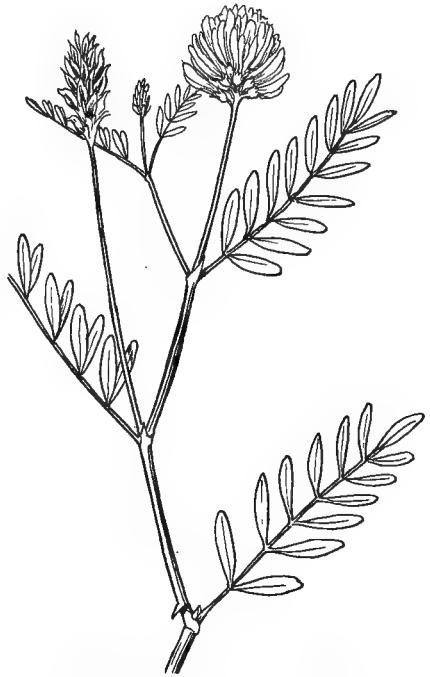
Milk Vetch (fig. 6). (See *Astragalus adsurgens*.)

FIG. 6.—Milk Vetch (*Astragalus adsurgens*).

Millet (*Chætochloa italica* and var. *germanica*).

This is one of the widest-grown hay crops in the Northwest. It thrives on a variety of soils and gives abundant crops of coarse but nutritious forage. The best quality of hay is obtained by cutting just before blossoming, but after the heads are well formed. It gives better results when fed with other forage than when fed alone. It is a common practice to give one feed per day of millet hay and one or two of timothy, prairie hay, or corn fodder. Millet requires but a short time in which to reach maturity, and hence is an excellent crop for the Northwest, where the seasons are never very long at best. The fact that it can be sown late in the spring and still mature a good crop makes it a good plant to use in subduing weeds. Many different varieties are grown, but the forms of the so-called "German" millets, as golden millet and Dakota millet, are preferred by farmers generally. Hungarian grass (var. *germanica*) is often grown, but is not prized as highly as either the "common" or the "German" millet on account of the lighter yield and a tendency to remain in the soil for some years as a weed.

Montana Sand-grass (*Calamagrostis montanensis*).

A low-growing grass, inhabiting dry sandy soils. The root leaves are usually produced in abundance and "furnish considerable pasturage early in the season and then 'sun-cure' on the buttes and hill-slopes, affording a large amount of winter feed."

Muhlenbergia mexicana. (*See Mexican Wood-grass.*)

Muhlenbergia pungens. (*See Blow-out grass.*)

Muhlenbergia racemosa. (*See Wild Timothy.*)

Munroa squarrosa. (*See False Buffalo-grass.*)

Narrow-leafed American Vetch (*Vicia americana linearis*).

This is a low-growing vetch which is found in dry soil in fields and waste places. It enters quite largely into the forage of certain localities. It spreads rapidly in poorly cultivated fields, and hence is sometimes regarded as a weed.

Native Meadow Oat-grass (*Avena americana*).

"A bunch grass of the high prairies which is not widely distributed in North Dakota." When present, it furnishes valuable forage.

Native Meadow Pea (*Lathyrus palustris*).

Often quite abundant in moist meadows and edges of thickets. It is often present in considerable quantity in lowland hay and undoubtedly increases the feeding value materially.

Needle-grass (*Stipa comata*).

Abundant in dry upland prairie soil in the central and western parts of the Dakotas.

It often forms a large percentage of the prairie hay. It is not cut until the "needles" have fallen, in order that they may not injure stock. In many localities on the high prairies between the James and Missouri rivers this grass often furnishes 50 per cent or more of the native hay.

Nerved Manna-grass (*Glyceria nervata*).

Abundant in shallow water and boggy meadows throughout the Northwest. It affords a large amount of excellent forage and forms an important element in lowland pastures and meadows. The seeds are a favorite food of wild fowl. This species, like Reed Meadow-grass, can be used to advantage in seeding down old sloughs or lake beds.

Old Witch-grass (*Panicum capillare*).

Common throughout the Northwest on waste and cultivated lands. Usually regarded as a weed, but often affords considerable forage in the fall, especially in stubble fields. The panicles break loose in autumn after the manner of Tickle-grass and are blown about by the wind, often in such numbers as to be quite troublesome.

Orchard-grass (*Dactylis glomerata*).

Occasional in cultivation and as an escape. It seems to be quite hardy in some localities, and should be cultivated more widely in this region. "This plant has been cultivated to some extent in North Dakota. It is reported to do well if plenty of seed is sown early in the spring. It withstands our summers better than timothy and would evidently pay well to use with red clover for meadows" (Brannon).

Oryzopsis micrantha.

This grass is quite generally distributed throughout the central and western parts of the Dakotas. It grows in dry sandy soil, and, though tough and wiry, is nutritious, and is considered a valuable grass. It is sometimes called Indian Millet, but a better common name would be Small Indian-millet, which would distinguish it from *Eriocoma*.

Oxytropis lambertii.

This plant is generally classed as one of the "loco weeds," and most observers agree in saying that stock will not eat it unless forced to do so by scarcity of forage; but according to Professor Brannon, "it is eaten readily by stock, and is present in sufficient quantities to rank with the valuable native upland forage plants."

Panicum capillare. (See Old Witch-grass.)

Panicum crus-galli. (See Barnyard-grass.)

Panicum miliaceum. (See Broom-corn Millet.)

Panicum scribnerianum. (See Small Panic-grass.)

Panicum virgatum. (See Switch-grass.)

Phalaris arundinacea. (See Reed Canary-grass.)

Phleum pratense. (See Timothy.)

Phragmites vulgaris. (See Reed-grass.)

Poa arida. (Bunch Spear-grass.)

A native species found in rather dry meadows and swales. It is an excellent grass and is frequently present in sufficient quantity to form a considerable portion of the forage in native meadows and pastures. It is quite abundant in portions of the James and Sioux valleys, and is certainly worthy of trial under cultivation. It is one of the first grasses to start in the spring and is usually in bloom in early June (fig. 7).

Poa buckleyana.

This is one of the most valuable "Bunch-grasses" in the Northwest. It is not so abundant in the Dakotas as it is in the regions nearer the Rocky Mountains, but still occurs in sufficient quantity in some of the drier localities to be an important element in the native forage.

Poa compressa.

There are several varieties of this grass found in this region. Some have been introduced, while others seem to be indigenous. The form known as "Canadian blue-grass" seems to do best under cultivation. It is hardier than Kentucky blue-grass and will thrive on poorer soils, and hence is preferable for upland pastures. It seldom grows large enough to afford much hay, but as a pasture grass yields a large amount of very nutritious forage. It is an excellent grass for sheep pastures on account of its ability to endure close grazing and excessive trampling. A form of this species which is apparently indigenous grows almost as large as Kentucky Blue-grass and should be given a trial under cultivation.

Poa flava. (See Fowl Meadow-grass.)

Poa nemoralis. (See Wood Meadow-grass.)



FIG. 7.—Bunch Spear-grass (*Poa arida*).

Poa nevadensis.

Found in a "low, but dry, meadow near Grand Forks." Said to be quite abundant in this particular locality and to yield a large amount of excellent hay. It appears to be worthy of cultivation.

Poa pratensis. (*See Kentucky Blue-grass.*)**Porcupine-grass** (*Stipa spartea*).

Abundant in dry prairies in the eastern part of both States. From the James River west it is largely replaced by Needle-grass (*Stipa comata*). The "spears" are very injurious to sheep and often do more or less injury to other stock. The plant produces an abundance of long root leaves which are valuable for forage. When closely pastured it can not develop seed, and hence is harmless, and the "spears" fall early, so that the hay may be obtained entirely free from them.

Prairie June-grass (*Kaleria cristata*).

This, one of the earliest native grasses, is abundant everywhere on dry prairies. Certain forms of it are also common in moist meadows in some localities. It is an excellent grass for early forage, and often forms a large part of the upland hay. It was much more plentiful the past season than it had been for a number of years, furnishing as much as 50 per cent of the forage in some places. Stockmen prize it very highly. It is called "Prairie Timothy" in some localities.

Red Clover (*Trifolium pratense*).

Cultivated in the older-settled portions, and often occurring as an escape in moist, protected ditches along railroads and waste places, where it seems to thrive quite well. It is being quite successfully grown in South Dakota in the Sioux Valley and in the Big Stone Basin. At Sioux Falls it has been grown with timothy for many years with very satisfactory results. "Various reports are given regarding its possible cultivation in North Dakota. The average opinion seems to be that it can not be successfully grown here. Personal observation teaches that it does well when sown in moist upland meadows which are somewhat protected, and that it does much better when mixed with timothy than when sown alone. It deserves to be cultivated more extensively" (Brannon).

Red-top (*Agrostis alba vulgaris*).

Cultivated more or less extensively in the moister portions of both States. Professor Brannon says "it yields a heavy crop in low, rather moist meadows, and does quite well on higher, dry ground." It does well in South Dakota in moist situations, and should be given a prominent place for mixtures to be sown on boggy lands or lake beds.

Reed Canary-grass (*Phalaris arundinacea*).

Common in low, moist meadows throughout the Northwest. In some localities it is being cultivated with good success. "It yields a large supply of excellent hay, which is greatly relished by all stock. The leaves remain green after fruiting, and the grass may be cut quite late and yet make very good hay. All observations and collections of this grass show that it is one of the most profitable lowland grasses in the State, and may be cultivated with confidence in moist or boggy soils" (Brannon).

Reed Fescue (*Scolochloa arundinacea*).

Rather a rare grass, growing in the shallow waters of sloughs and lake beds, occasionally occurring in sufficient quantity to form an important element in the lowland hay. It yields heavily, but is not very rich in the more important nutrient substances. It fruits abundantly, and might be used to advantage on very wet meadow lands.

Reed-grass (*Phragmites vulgaris*).

More or less abundant throughout in sloughs and margins of lakes and streams. It grows too large to be very valuable as a forage plant. While it is young it is often eaten by stock, and it is sometimes used for fodder, but its principal use is for thatching granaries and stock sheds. The "plumes" are much used for dry bouquets in winter decorations. On the sand bars along the Missouri River the rootstocks grow to an enormous length.

Reed Meadow-grass (*Glyceria aquatica*).

Common in shallow water, often furnishing a considerable part of the hay obtained from wet boggy meadows. The forage is relished by stock, but is not high in feeding value. The seeds are produced in abundance and form an important part of the food of wild fowl. It is a good grass for use in reclaiming old sloughs, bogs, and lake beds.

River Club-rush (*Scirpus fluriatilis*).

This rush is quite abundant in many places along fresh-water streams, lakes, and ponds and in sloughs. It is one of the most important of the rushes growing in this region, furnishing a large amount of forage which is relished by stock early in the season. It is an important element in "slough grass hay," and, though coarse, is readily eaten by stock and contains a high percentage of crude protein. It yields an abundance of seed, which makes an excellent food for poultry and has even been fed to cattle and horses with good results. It should be crushed or ground up when fed to stock, on account of the very hard seed coats. The large shallow lakes common in parts of the Dakotas are often almost entirely covered with this plant. Very frequently the lakes dry up in the latter part of the summer and many hundreds of tons of hay are cut from them.

Rush (*Scirpus* spp. and *Juncus* spp.).

For the more important kinds see Bog-rush, River Club-rush, and Meadow-rush.

Russian Thistle (*Salsola tragus*).

This vile weed has become quite generally distributed throughout the Northwest. When other forage is scarce stock will eat this plant quite readily either in the fresh state or when cured for hay, especially if, in the latter case, it is mixed with oat or millet hay. It has been fed to sheep with best results and many farmers in this region have wintered their flocks with little else in the shape of "roughness." But while many follow this practice if the "thistle" is already present on the farm, no one would recommend it to be sown for forage on account of its pernicious habits as a weed.

Rhynchospora capillacea. (See Slender Beak-rush.)**Salt-bushes (*Atriplex* spp.).**

These plants occur in greater or less abundance in saline soils throughout the Northwest. One or two species have been introduced and several are indigenous. In many places in central and western Dakota these plants constitute a large part of the vegetation and furnish much of the native forage. All kinds of stock eat them with greater or less readiness and sheep are particularly fond of them. It is quite probable that some of the Australian salt-bushes could be introduced with profit into the regions where our native species flourish.

Salt-grass (*Distichlis spicata stricta*).

Abundant in saline soils throughout the Northwest. It is seldom eaten by stock unless there is a scarcity of better grasses. In the Bad Lands and elsewhere on the ranges, however, it is of considerable importance, as it thrives on soils that will produce but few other grasses. Sheep eat it more readily than other stock. It thrives along the irrigating ditches where they run through the "alkali" spots.

Sand-bur (*Cenchrus tribuloides*).

This grass occurs in great abundance in sandy soil in the Missouri Valley and, though stock eat it while young, it is regarded as a vile weed on account of the "burs" which are formed by the matured spikelets.

Sand Vetch (*Vicia villosa*).

This vetch is one of the hardiest legumes that has been cultivated for forage in the Northwest. It endures drought perfectly, grows rapidly, yields well, and is in condition to use at a time when the native forage is likely to be short on account of the dry weather of July and August. Its feeding value is very high and the forage in the fresh or dry state is greedily eaten by stock. At Brookings, Mellette, and elsewhere in South Dakota, as well as in North Dakota, it has given the best results. For summer soiling, for which it is most valuable, it may be sown in April or May, using a bushel to a bushel and a half of seed per acre with a like quantity of oats or other small grain. It should be fed in connection with plenty of prairie grass, grain straw, and like forage in order that all of the protein may be utilized. Green Corn, Cane, or Kaffir Corn can be fed with it to good advantage. The only obstacle in the way of the general cultivation of this vetch is the scarcity of seed and the difficulty in saving it in any large quantity, due to the habit of the plant of ripening seed in such small amounts at a time and continuing to bud and blossom until it freezes up in the fall.

Savastana odorata. (See Sweet-grass.)**Schedonnardus paniculatus**. (See Wild Crab-grass.)**Scirpus atrovirens pallidus**. (See Meadow-rush.)**Scirpus fluviatilis**. (See River Club-rush.)**Scirpus lacustris**. (See Great Bulrush.)**Scirpus robustus**. (See Sea Club-rush.)**Scolochloa arundinacea**. (See Reed Fescue.)**Sea Club-rush** (*Scirpus robustus*).

More or less abundant in brackish water in both the Dakotas. What has been said regarding the uses of River Club-rush will apply equally well to this species.

Sedges (*Carex* spp.).

There is a great variety of sedges growing in this region. Though most of them are too rare to be of much economic importance, there are a few which add materially to the native forage in certain localities. Giant Sedge (*Carex aristata*) and Upright Sedge (*C. stricta*) afford a large amount of hay and pasturage on wet, boggy lands. Straw-colored Sedge (*Carex straminea*) and its relatives, with Silvery-topped Sedge (*Carex siccata*) and Brown-topped Sedge (*C. sartwellii*), add more or less to the forage of the drier meadows. On the dry uplands Dwarf Sedge (*Carex stenophylla*) and other small species, like *Carex pennsylvanica* and *C. communis*, form an important element in the pasturage, particularly early in the season before the true grasses have developed sufficiently for grazing.

Sheep's Fescue (*Festuca ovina*).

This is one of the most valuable of the Fescues for this region. Certain forms of this species are indigenous to the Black Hills region of South Dakota. Sheep's Fescue thrives on sandy soils and is an excellent plant for use in upland pastures, particularly those in which sheep are allowed to run. It is very hardy and grows well from seed. Red Fescue (*Festuca rubra*) has also been cultivated more or less in the Dakotas, and in some respects is even more desirable than Sheep's Fescue. It forms a better sod and is a stronger grower.

Short-leaved Eatonia (*Eatonia nitida*).

Found occasionally in the eastern part of North Dakota. The forage is of good quality, but the grass is too rare to be of much importance.

Sisyrinchium angustifolium. (See Blue-eyed grass.)**Slender Beak-rush** (*Rhynchospora capillacea*).

Rare and too small to be of any importance as a forage plant.

Slender Cord-grass (*Spartina gracilis*).

Much like the common Cord-grass, but smaller and of less importance agriculturally.

It occurs in moist saline soils, and, to a certain extent, replaces the larger species in the western part of the Dakotas.

Slender Fescue (*Festuca octoflora*).

A slender annual found on dry, rocky knolls. It adds more or less to the forage during the early part of the season, but it ripens its seeds and dries up so early that it is of little importance agriculturally. Its chief value lies in the fact that it thrives on soils upon which few other grasses will grow.

Slender Wheat-grass (*Agropyron tenerum*).

This is one of the best of the wheat-grasses. It is not so aggressive as some of the other species, as it does not spread by means of underground stems. It responds quickly to cultivation and gives heavy yields of first-class hay. It should receive more attention from farmers and stockraisers. (See fig. 1.)

Slough-grass (*Beckmannia erucaeformis*).

Abundant in sloughs and wet places. While young it is much relished by stock, and often forms a considerable amount of the forage in low pastures and meadow lands. The hay, though readily eaten by stock, is not rich in crude protein, and hence is not so valuable as that of many other grasses in this region. In the artesian basin this grass is spreading rapidly along the streams formed by the waste water from the wells, and it seems possible that it may become an important grass in localities where better species can not be grown (fig. 8).

Small Panic-grass (*Panicum scribnerianum*).

Not uncommon in rather dry upland meadows, furnishing a small amount of nutritious forage.

Smooth Brome-grass (*Bromus inermis*).

An introduced species, which is rapidly becoming one of the most important forage plants of this region. Its hardiness, heavy yield of both forage and seed, and the ease with which a good stand can be obtained make it a very desirable grass for permanent meadows and pastures. It is not a good grass to use in short rotations, as the very characters which render it so hardy and so desirable for permanent fields enable it to persist in the soil, and hence it may become a weed under such conditions.

Sorghum (*Andropogon sorghum* vars.).

The saccharine sorghums are often cultivated for the manufacture of molasses and also for forage. For the latter purpose they are usually sown broadcast or in



FIG. 8.—Slough-grass
(*Beckmannia erucaeformis*).

drills and cut and fed green as a soiling plant or cured for hay. They are very greedily eaten by stock of all kinds, and nearly all who have tried growing them for forage are well pleased with the results obtained. The Early Amber varieties seem to be the favorites in this region, particularly the one known as Minnesota Early Amber.

Southern Poverty-grass (*Sporobolus vaginæflorus*).

This species is very common in eastern and southern South Dakota in dry soil along railroad grades, in waste places, and neglected fields. Though often eaten by stock, it affords but little forage and has practically no agricultural value.

Southern Spear-grass (*Eragrostis purshii*).

More or less common in dry soil, in waste places, and along railroad grades. Of little value agriculturally.

Spartina cynosuroides. (See Cord-grass.)

Spartina gracilis. (See Slender Cord-grass.)

Spiked Muhlenberg's-grass. (See *Muhlenbergia racemosa*.)

Spike-rush (*Eleocharis* spp.).

These little rushes often furnish a considerable amount of forage in wet, boggy meadows and pastures. They are relished by stock and compare favorably in feeding value with the grasses growing in similar places.

Sporobolus airoides.

Common in saline soils in the Bad Land regions, where it affords more or less forage and is quite highly prized by stockmen.

Sporobolus asperifolius. (See Fine-topped Salt-grass.)

Sporobolus brevifolius.

A grass of little agricultural value, growing in rather dry soils. It is often called "prairie-grass" and "wire-grass."

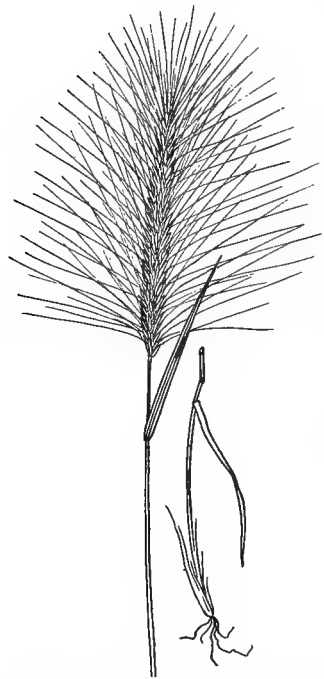


FIG. 9.—Squirrel-tail-grass (*Hordeum jubatum*).

Sporobolus cryptandrus.

More or less widely distributed throughout the Northwest in dry sandy soils. It is of little importance except perhaps in the Bad Lands, where it is often very abundant and is said to be "readily eaten by range cattle."

Sporobolus heterolepis. (See Wire-grass.)

Sporobolus longifolius. (See Long-leaved Prairie-grass.)

Sporobolus vaginæflorus. (See Southern Poverty-grass.)

Squirrel-tail (*Hordeum jubatum*).

This grass has become very abundant throughout nearly all parts of the Northwest.

It furnishes a considerable amount of good pasturage early in the season, but later becomes a very bad pest. The rough "beards" work into the mouths of stock, especially horses, and cause ulcerated sores. Not unfrequently the animal becomes almost unable to eat, and unless promptly relieved may be permanently injured. The "beards" are also a source of annoyance to anyone walking through a field containing the pest, as they work into the clothing and can only be dislodged with difficulty (fig. 9).

Stink-grass (*Eragrostis major*).

A common grass of weedy habit. It yields considerable forage but stock avoid it, except when it is young or when cured as hay, on account of the strong odor given off by the inflorescence.

Stipa comata. (*See* Needle-grass.)**Stipa spartea.** (*See* Porcupine-grass.)**Stipa viridula.** (*See* Feather Bunch-grass.)**Swamp-chess** (*Bromus ciliatus*).

Widely distributed in dry woodland pastures, but seldom occurring in sufficient quantity in any one locality to afford much forage.

Sweet-grass (*Savastana odorata*).

This sweet-scented grass is quite generally distributed throughout the eastern part of both States. It possesses very little value as a forage crop, but the panicles are very much prized for filling sofa pillows and for winter bouquets. It sometimes becomes quite a pest in wheat fields, as it is difficult to eradicate on account of its strong rootstocks.

Switch-grass (*Panicum virgatum*).

Grows abundantly on moist meadows and to some extent on dry ground throughout the Northwest. It is a hardy grass and a strong grower, furnishing a large amount of pasturage, or, if allowed to stand until it blooms, yields a large crop of nutritious hay. It should be cut rather early to avoid the woody stems and loss of seed. When mature, the seed can be readily secured and the grass might be cultivated to advantage. In some localities it is known as "False Red-top." It thrives in the vicinity of the artesian waters and would doubtless improve rapidly under irrigation.

Tall Fescue (*Festuca elatior*).

Occasional in cultivation. It does well in low, rich meadows, but does not thrive on the upland soils and is less valuable for this region than Meadow Fescue.

Tall Grama (*Bouteloua racemosa*).

This grama is found throughout both States on the upland prairies. It is not so well liked by stock as "Blue Grama" and many other of the prairie grasses, hence it is not so valuable a pasture grass. It produces a fine growth of long root leaves which, when cut for hay, are readily eaten by stock, and it thrives better on light dry soils than most other species; consequently it is one of the most important hay grasses of the region.

Tall Oat-grass (*Arrhenatherum elatius*).

This is an excellent grass for meadows, and, though it does best on lowlands, gives fairly good returns on upland farms. It deserves a more general cultivation in the Dakotas and elsewhere in the Northwest. The forage is of excellent quality. The grass has given splendid results at Brookings and Mellette, S. Dak., and can be grown to the best advantage in mixtures with Red-Top, the Fescues, and like grasses.

Tickle-grass (*Agrostis scabra*).

Common everywhere, but of little value agriculturally.

Timothy (*Phleum pratense*).

Cultivated, and occurring as an escape. It is extensively grown throughout a large portion of South Dakota, which is becoming one of the most important "timothy-seed" growing States in the Union. "It is successfully grown in the moister portion of North Dakota. The first crop is reported to be the best and each succeeding one is lighter. The slight rainfall in many parts of the State hinders its cultivation in those regions. It yields a very good crop when mixed with a clover of some sort. It is improving with each succeeding season, which is due to the change in soil and climate, and indicates that it will become an important hay-producing plant in this State in the near future" (Brannon).

Trifolium beckwithii. (*See Beckwith's Clover.*)

Trifolium hybridum. (*See Alsike.*)

Trifolium pratense. (*See Red Clover.*)

Trifolium repens. (*See White Clover.*)

Tufted Hair-grass (*Deschampsia cespitosa*).

"Grows in bunches in moist meadows and affords considerable hay, but unless it is cut early it is quite woody and lacking in nutrition" (Brannon).

Turkey-foot. (*See Andropogon hallii and A. provincialis.*)

Vicia americana. (*See American Vetch.*)

Vicia americana linearis. (*See Narrow-leaved American Vetch.*)

Vicia villosa. (*See Sand Vetch.*)

Vigna catjang. (*See Cow Pea.*)

Western Beard-grass (*Aristida fascicularis*).

More or less abundant in dry, sandy soils on prairies, waste places, and on gravelly knolls. While young it is eaten by stock, but the stems soon become so tough and wiry as to be unpalatable even in hay, and the grass is very difficult to cut with a mower. It has little value agriculturally.

Western Quack-grass (*Agropyron pseudorepens*).

Similar in distribution to Western Wheat-grass and, like that species, a valuable forage grass. (*See also Agropyron.*)

Western Wheat-grass (*Agropyron spicatum*). (*See Agropyron.*)

White Clover (*Trifolium repens*).

This is the most commonly grown clover in the Northwest. Though of no value for hay, it is an excellent pasture plant and thrives on a variety of soils. Its ability to withstand close grazing and excessive trampling makes it a good plant for sheep pastures. It is extensively grown on lawns and in dooryards.

White Sweet Clover (*Melilotus alba*).

Not infrequent in cultivation and occasionally as an escape. It is rather unpalatable as a forage, and stock will seldom eat it unless mixed with other fodder. It is an excellent honey plant, however, and is often grown for this purpose. It is perfectly hardy in the Northwest, and gives heavy yields under irrigation. "This plant was seen growing on irrigated ground on the southern slope of Turtle Mountains. It was 5 or 6 feet high and grew in a very dense mass. The owner had endeavored to clear the place of the plant, but had not been successful. It makes such an immense growth that it might be of considerable value for silage" (Brannon).

Wild Barley (*Hordeum nodosum*).

This grass seems to be rather rare in this region. It grows in moist, saline soils, but seldom occurs in sufficient quantity to be of much importance as a forage plant. Stock eat it readily, particularly before it "heads out."

Wild Crab-grass (*Schedonnardus paniculatus*).

An inconspicuous grass occurring in dry, sandy soils on prairies and in waste places. It is most abundant in central and western South Dakota, and is of practically no importance agriculturally.

Wild-oats (*Avena fatua*).

This grass has been introduced into grain fields and along railroads. Though it affords fairly good forage if cut while young, it is not so valuable for this purpose as common oats, and when once started in a field it is very difficult to get rid of. It is therefore to be regarded as a weed, and should be destroyed at once.

Wild-rye (*Elymus canadensis*).

Occurs in almost every section of the Northwest, and in some places yields a large crop of excellent hay. It is also valuable for early pasturage. It is frequently affected with ergot and should be cut before the fungus has developed.

Wild Timothy (*Muhlenbergia racemosa*).

More or less frequent in the eastern part of both States, generally on rather moist land. It yields well, but the forage is of only average quality. In some localities it is highly valued.

Wild Vetch (*Hosackia purshiana*).

This is probably the most valuable of the native vetches. It occurs throughout the Northwest in rather sandy soils. All kinds of stock eat it greedily, both in the green state and as hay, and stockmen regard it as one of the best forage plants



FIG. 10.—Wild Vetch (*Hosackia purshiana*).

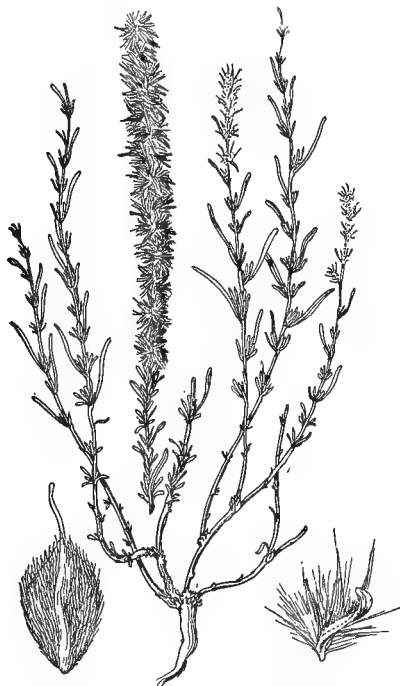


FIG. 11.—Winter Fat (*Eurotia lanata*).

in the region. It has been much more abundant the past season than usual. It is more than likely that this plant will prove valuable for cultivation in sandy soils. In many localities along the Missouri River this vetch forms a considerable part of the native hay (fig. 10).

Wild Water Foxtail (*Alopecurus geniculatus* and var. *fulvus*).

More or less abundant in wet, boggy places. It affords a small amount of very good forage.

Winter Fat (*Eurotia lanata*).

A woolly, half-shrubby perennial found more or less abundantly in central and western Dakota. It thrives on "alkali" lands, and is much prized as a winter forage. It is claimed that animals eating this plant are less likely to be unhealthy, as it acts as a preventive of disease (fig. 11).

Wire-grass (*Sporobolus heterolepis*).

More or less abundant in dry meadows, on hillsides, and along swales. It is not relished by stock while in bloom on account of a strong, disagreeable odor which it gives off. At other times, however, and particularly when it is cured, stock eat it readily. The yield of forage is large because of the abundance of root-leaves produced. In the Sioux Valley it forms an important element in the native forage.

Wood Meadow-grass (*Poa nemoralis*).

Abundant in dry woodlands and broken prairies, often affording a great deal of forage.

Yellow Foxtail (*Chenopodium glauca*).

An introduced grass of weedy habit more or less common throughout the Northwest. Though a vile weed under most circumstances, like Green Foxtail, it may be used for forage to good advantage when it occurs in sufficient abundance and better forage is scarce. It is often called "Pigeon-grass" by farmers.

Yellow Sweet Clover (*Melilotus officinalis*).

This legume is perfectly hardy and gives an immense yield of forage. As with White Sweet Clover, stock will not eat it very well alone, because of a bitter substance which is present in considerable quantity. "This plant grows luxuriantly in the Turtle Mountains. It is not very valuable for forage, but may be cut with other forage plants while tender and the mixed hay will be readily eaten by stock. The abundant growth of the sweet clovers is in correspondence with other observations on the favorable adaptation of the soil and climate to the luxuriant growth of many valuable *leguminosae*" (Brannon).

Zizania aquatica. (See Indian Rice.)

A CLASSIFIED LIST OF THE GRASSES AND FORAGE PLANTS COLLECTED OR OBSERVED IN THE DAKOTAS IN 1896.

GRAMINEÆ.

ANDROPOGONEÆ.

Andropogon hallii Hack.

North Dakota: Rugby Junction (Brannon 101).

South Dakota: Iron Springs in the Bad Lands (Williams).

Dry soil of sand hills.

Andropogon nutans L.

North Dakota: Grand Forks (Brannon 41), Oakes.

South Dakota: Aberdeen (Griffiths 103), Frankfort (Griffiths 52), Brookings, Plankinton (Wilcox 23), Chamberlain (Wallace 50).

Dry bottoms, rare except in the Sioux Valley.

Andropogon provincialis Lam.

North Dakota: Dickinson (Brannon 135), Minot, Bottineau, Devil's Lake, Jamestown, Grand Forks.

South Dakota: Brookings, Frankfort (Griffiths 59a, 59b), Aberdeen (Griffiths 135), Huron (Griffiths 20), Pierre (Griffiths 38), Blunt, Plankinton, Sioux Falls, White River (Wallace 15), Aurora County (Wilcox 51).

Moist prairies, chiefly east of the Missouri. Mr. Griffiths' number 59b has the leaves and sheaths more or less hairy, and has been called *var. villosus* by various writers.

Andropogon scoparius Michx.

North Dakota: Grand Forks (Brannon 26), Devil's Lake, Oakes, Jamestown, Bad Lands.

South Dakota: Aberdeen (Griffiths 138), Huron (Griffiths 19), Frankfort (Griffiths 51), Brookings, Plankinton, Pierre, Bad Lands, White River (Wallace 13, 14), Aurora County (Wilcox 50).

Dry prairies.

PANICEÆ.

Beckmannia erucæformis Host.

North Dakota: Grand Forks (Brannon 28), Larimore, Church's Ferry, Minot, Bismarck.

South Dakota: Brookings (Wilcox 57), Plankinton (Wilcox 8), Iroquois, Artesian, City (Wilcox 59).

In wet ground along coulees and sloughs. It is becoming abundant along irrigating ditches and about reservoirs.

Panicum capillare L.

North Dakota: Medora (Brannon 134), Grand Forks, Oakes, Fargo.

South Dakota: Huron (Griffiths 7, 15), Aberdeen (Griffiths 120), Brookings, Cheyenne River (Wallace 2), White River (Wallace 46) a very depauperate form.

In dry soil of fields, in sandy basins, and on rolling prairies.

Panicum crus-galli L.

North Dakota: Church's Ferry (Brannon 56), Minot, Dickinson, Medora, Devil's Lake, Oakes, Jamestown, Grand Forks, Fargo.

South Dakota: Brookings, Frankfort (Griffiths 58a², 58b), Watertown, Redfield, Sioux Falls, Doland, Iroquois, Aurora County.

Moist ground in fields, etc., becoming very abundant along irrigating ditches and about reservoirs.

Panicum crus-galli muticum Vasey.

South Dakota: Aberdeen (Griffiths 108), Huron (Griffiths 14), Frankfort (Griffiths 58a, 58b²), Brookings, Sioux Falls, Iroquois.

Fields and waste places. Like the species, it is becoming plentiful along irrigating waters.

Panicum depauperatum Muhl.

South Dakota: Brookings (Wilcox 14), Aurora County, along Firesteel Creek.

Dry fields and prairies. The Brookings specimens are thickly covered with long hairs; the panicles are all borne on shortened stalks and the stem is much branched above.

Panicum miliaceum L.

South Dakota: Brookings, Aberdeen, Groton, Sioux Falls.

Cultivated, and often occurring as an escape.

Panicum proliferum Lam.

Jefferson, Greene County, Iowa (Wilcox 27).

Moist soil along roadsides, etc.

Panicum pubescens Lam.

South Dakota: Rosebud (Wallace 1).

Dry soil of uplands, rare.

Panicum scribnerianum Nash. (*Panicum scoparium* of the manuals).

North Dakota: Merrifield (Brannon 10), Oakes.

South Dakota: Rosebud (Wallace 28), Brookings, Aurora County.

Rather dry, open ground. It is common in the Sioux Valley, but it is apparently rare elsewhere.

***Panicum scribnerianum leibergii* Scribn.**

South Dakota: Brookings (Wilcox 16).

Low, moist prairies and bottom lands, not yet found outside of the Sioux Valley.

Distinguished from the species by its larger size, more conspicuously tuberculate-hairy leaves and sheaths, and contracted panicle. It has much of the aspect of *P. xanthophyllum* Gray, but that species has smooth leaves and the lower empty glume is longer.

***Panicum virgatum* L.**

North Dakota: Dunseith (Brannon 99), Minot, Church's Ferry, Minnewaukon, Dickinson, Grand Forks, Fargo, Oakes.

South Dakota: Frankfort (Griffiths 53), Huron (Griffiths 22), Aberdeen (Griffiths 82, 132), Brookings (Wilcox 15), Aurora County (Wilcox 54), along Firesteel Creek, Watertown, Sioux Falls, White River (Wallace 3, 4, 5). Generally on moist prairies and bottom lands, but occasionally found in drier soils. The last one of Mr. Wallace's specimens is a very much dwarfed form.

***Panicum wilcoxianum* Vasey.**

South Dakota: Brookings.

Dry soil, rare. It probably occurs elsewhere in the State, being confused with *P. scribnerianum* and *P. depauperatum*, between which it is intermediate.

***Chætochloa glauca* (L.) Scribn. in Bull. 4, Div. Agros., p. 39 (1897).**

South Dakota: Frankfort (Griffiths 54), Brookings, Sioux Falls, Iroquois, Aurora County.

Chætochloa italica* (L.) Scribn. *l. c.

Cultivated more or less extensively throughout the agricultural regions of both States, and often occurring as an escape in old fields and waste places.

***Chætochloa italica germanica* (Mill.) Scribn. (*Panicum germanicum* Mill.)**

North Dakota: Webster's Chapel (Brannon 55), Church's Ferry, Langdon, Grand Forks, Fargo.

South Dakota: Brookings, Aberdeen, Watertown, Sioux Falls. Cultivated, and occasionally escaped.

Chætochloa viridis* (L.) Scribn. *l. c.

North Dakota: Devil's Lake (Brannon 50), Minot, Bottineau, Fargo, Grand Forks, Dickinson, Oakes.

South Dakota: Aberdeen (Griffiths 123), Brookings, Sioux Falls, Iroquois, Aurora County.

In dry soil of cultivated fields.

***Cenchrus tribuloides* L.**

South Dakota: Pierre (Griffiths 30, 34), Chamberlain, Vermilion, Elk Point. Sandy soil in fields and waste places.

ORYZÆ.

***Zizania aquatica* L.**

South Dakota: Huron (Griffiths 8), Tacoma Park (Griffiths 118), Brookings (Wilcox 33, 34), Sioux Falls.

Edges of streams and lakes.

***Homalocenchrus oryzoides* (L.) Poll.**

South Dakota: Frankfort (Griffiths 49), Huron (Griffiths 10), Redfield (Griffiths 79), Brookings, Davison County (Wilcox 28), Bear Creek (Wallace 64).

Wet places along margins of streams.

Homalocenchrus virginicus (Willd.) Britton.

South Dakota: Brookings (Wilcox 70), Sioux Falls, Aurora County.
Low, wet places in woods and on banks of streams.

PHALARIDÆ.

Phalaris arundinacea L.

North Dakota: Church's Ferry (Brannon 59), Grand Forks, Merrifield, Devil's Lake, Oakes.

South Dakota: Brookings (Wilcox 71), Aberdeen (Griffiths 127), Mellette (Griffiths 147), Aurora County (Wilcox 38), Antelope Creek (Wallace 42).

On low, wet ground or in shallow water; occasionally found in cultivation.

Savastana odorata (L.) Scribn.

North Dakota: Willow City (Brannon 80), Grand Forks (Brannon 4), Devil's Lake, Langdon, Minot, Church's Ferry.

South Dakota: Brookings (Wilcox 17), Iroquois, Oakwood Lakes.
Moist meadows and fields.

AGROSTIDÆ.

Aristida basiramea Engl.

On the Waupsipinicon River, Iowa (Wilcox 30).
Dry soil.

Aristida fascicularis Torr.

South Dakota: Canning (Griffiths 43), Redfield (Griffiths 68), Aurora County (Wilcox 35), Rosebud (Wallace 34), White River (Wallace 33).

Aristida gracilis Elliott.

Waupsipinicon River, Iowa (Wilcox 31).
Dry banks, etc.

Stipa comata Trin. and Rupr.

North Dakota: Devil's Lake (Brannon 54), Merrifield (Brannon 23), Dickinson (Brannon 122), Grand Forks, Bottineau, Willow City, Church's Ferry, Oakes, Jamestown, Mandan.

South Dakota: Brookings (Wilcox 47), Aberdeen (Griffiths 86), Aurora County, Huron, Blunt, Indian Creek.

Dry, sterile soils, most abundant in the regions west of the James River.

Stipa spartea Trin.

North Dakota: Church's Ferry (Brannon 72), Grand Forks (Brannon 12), Devil's Lake, Bottineau, Minot, Dickinson, Fargo.

South Dakota: Brookings, Sioux Falls, Millbank, Aurora County.
Dry upland prairies, most abundant east of the James River.

Stipa viridula Trin.

North Dakota: Minot (Brannon 113), Dickinson, Oakes, Jamestown, Bismarck, Mandan.

South Dakota: Aberdeen (Griffiths 130), Huron, Blunt (Griffiths 107), Brookings (Wilcox 11), Aurora County (Wilcox 40), Rosebud (Wallace 35).

In dry soil of high prairies.

Sporobolus airoides Torr.

South Dakota: White River (Wallace 38), Indian Creek.
Dry, sterile soil of the Bad Lands region.

Sporobolus longifolius (Torr.) Wood.

North Dakota: Oakes.

South Dakota: Frankfort (Griffiths 48), Redfield (Griffiths 71), Brookings, Aurora County (Wilcox 21), Indian Creek (Wallace 32), Ree Heights (Griffiths 45).
Dry, rather sandy soil, in prairies and along railroad grades.

***Sporobolus asperifolius* Thurb.**

South Dakota: Aurora County, Indian Creek, Iroquois (Wilcox 67).
Dry, sterile soil, abundant in the Bad Lands and on the ranges west of the Missouri.

***Sporobolus brevifolius* (Nutt.) Scribn. (*S. cuspidatus* of the manuals.)**

North Dakota: Grand Forks (Brannon 48), Medora (Brannon 139), Minnewaukon (Brannon 65), Dickinson, Oakes.
South Dakota: Brookings (Wilcox 12), Redfield (Griffiths 70), Frankfort (Griffiths 60), Huron (Griffiths 12), White River (Wallace 37), Indian Creek (Wallace 36), Aurora County (Wilcox 52, 53).
Dry soil, throughout both the Dakotas.

***Sporobolus cryptandrus* (Torr.) Gray.**

North Dakota: Medora (Brannon 125), Oakes.
South Dakota: Pierre (Griffiths 25, 32), Scatterwood (Griffiths 91, 104), Aurora County (Wilcox 6).
Dry, sandy soil.

***Sporobolus heterolepis* Gray.**

North Dakota: Willow City (Brannon 77), Minot (Brannon 112), Dickinson (Brannon 132).
South Dakota: Brookings (Wilcox 10), Sioux Falls, Flandreau.
In dry soil along the borders of swales and on hillsides.

***Sporobolus vaginæflorus* (Torr.) Vasey.**

South Dakota: Brookings, Sioux Falls, Aberdeen (Griffiths 94), Redfield (Griffiths 65), Pierre (Griffiths 36), Wessington (Griffiths 42), Huron, Iroquois, Aurora County (Wilcox 20).

***Muhlenbergia racemosa* (Michx.) B. S. P.**

North Dakota: Girard Lake (Brannon 88), Oakes.
South Dakota: Brookings, Sioux Falls, Aberdeen (Griffiths 133), Redfield (Griffiths 77), Huron (Griffiths 21), Pierre (Griffiths 28, 35), Aurora County (Wilcox 26), White River (Wallace 30).
Dry bottom lands.

***Muhlenbergia mexicana* Trin.**

South Dakota: Huron (Griffiths 6), Brookings, Sioux Falls, Aurora County (Wilcox 25).
Moist bottom lands. Griffiths' No. 6 is a form approaching the preceding species.

***Muhlenbergia pungens* Thurb.**

South Dakota: Rosebud (Wallace 61).
Sandy soil of "blow outs," etc.

***Eriocoma cuspidata* Nutt.**

North Dakota: Rugby Junction (Brannon 96), Dickinson.
South Dakota: Bad Lands along the Cheyenne River (Wallace 39).
In sterile, sandy soil, growing in dense bunches.

***Oryzopsis micrantha* Thurb.**

South Dakota: Top of Sheep Mountain, near Cheyenne River (Wallace 40).
Sterile, sandy soil.

***Phleum pratense* L.**

North Dakota: Grand Forks (Brannon 18), Iola, Church's Ferry, Hillsboro, Fargo, Oakes.

South Dakota: Millbank, Watertown, Brookings, Sioux Falls, Mellette (Griffiths 144), Plankinton.

Cultivated lands.

***Alopecurus geniculatus* L.**

South Dakota: Head of White Willow Creek (Wallace 56).

Wet soil.

***Alopecurus geniculatus fulvus* (Smith) Scribn.**

North Dakota: Grand Forks (Brannon 30), Devil's Lake, Fargo.

South Dakota: Brookings, Sioux Falls, Salem, Aurora County (Wilcox 55, 69), Rosebud (Wallace 28).

Wet, boggy meadows, and in shallow water.

***Agrostis alba* L.**

North Dakota: Red River Valley.

South Dakota: Brookings, Frankfort (Griffiths 56), Redfield (Griffiths 78), Sioux Falls.

***Agrostis scabra* Willd.**

North Dakota: Bottineau (Brannon 82), Langdon, Grand Forks, Dunseith (Brannon 98), Rugby Junction, Minot (Brannon 111), Medora, Fargo, Dickinson, Willow City (Brannon 81).

South Dakota: Brookings (Wilcox 64), Sioux Falls, Salem, Huron, Aurora County, head of White Willow Creek (Wallace 41).

In dry or moist soil everywhere.

***Calamagrostis americana* (Scribn.) Scribn. Bull. 5, Div. Agros., p. 27 (1897). (*C. robusta* Vasey, not Phillipi.)**

North Dakota: Willow City (Brannon 76), Church's Ferry, Grand Forks, Oakes, Fargo.

South Dakota: Brookings (Wilcox 48, 49, 61, 62), Plankinton (Wilcox), Huron, Aberdeen (Griffiths 95), Rosebud (Wallace 31).

In moist soil of lowlands.

Mr. Wilcox's No. 61 is a form with the inflorescence much more contracted than usual.

***Calamagrostis canadensis* Beauv.**

North Dakota: Church's Ferry (Brannon 61, 63), Minot, Devil's Lake, Oakes, Fargo.

South Dakota: Brookings, Sioux Falls, Arlington, Aberdeen, Huron, Plankinton.

In moist soil, becoming quite abundant along irrigating ditches and about reservoirs.

***Calamagrostis scribneri* Beal. (*Calamagrostis dubia* Scribn.).**

North Dakota: Bottineau (Brannon 91), Edinburg.

Moist soil of low prairies.

***Calamagrostis montanensis* Scribn.**

North Dakota: Medora (Brannon 130).

South Dakota: Brookings, Rondell (Griffiths 129), Aurora County (Wilcox 44).

Dry hills and prairies.

***Calamovilfa longifolia* (Hook.) Scribn.**

North Dakota: Dickinson (Brannon 118), Medora, Mandan, Bottineau, Church's Ferry, Minnewaukon, Minot, Oakes, Fargo.

South Dakota: Brookings (Wilcox 13), Sioux Falls, Salem, Iroquois, Huron, Watertown, Aberdeen (Griffiths 113, 136), Pierre (Griffiths 29), Aurora County (Wilcox 56), White River (Wallace 49).

Sandy soil.

AVENEE.

Deschampsia cæspitosa Beauv.

North Dakota: Inkster (Brannon 34).

In moist soil of low meadows.

Avena fatua L.

North Dakota: Grand Forks (Brannon 49), Dickinson (Brannon 115).

South Dakota: Castlewood (Griffiths 141), Elkton, Deuel County.

In dry cultivated fields and along railroad grades.

Avena americana Scribn.

North Dakota: Langdon (Brannon 38).

In dry soil on high prairies. Culms in bunches.

Avena sativa L.

North Dakota: Inkster (Brannon 40).

Adventitious along roadsides. Extensively cultivated throughout both the Dakotas.

Arrhenatherum elatius (L.) Beauv.

South Dakota: Brookings, Mellette (Griffiths 142).

Cultivated, and occasionally as an escape.

CHLORIDEÆ.

Schedonnardus paniculatus (Nutt.) Trelease.

South Dakota: Aberdeen (Griffiths 121), Pierre (Griffiths 31), Aurora County (Wilcox), Cheyenne River at the mouth of Battle Creek (Wallace 43).

Dry sterile soil.

Spartina cynosuroides Willd.

North Dakota: Dickinson (Brannon 119), Red River Valley, Oakes, Mandan.

South Dakota: Brookings, Sioux Falls, Aberdeen (Griffiths 96, 116), Huron (Griffiths 3), Firesteel Creek (Wilcox).

More or less abundant in sloughs and along irrigating ditches.

Spartina gracilis Trin.

North Dakota: Minnewaukon (Brannon 64), Bad Lands west of the Missouri.

South Dakota: Aberdeen (Griffiths 125), Clark County (Carter), Cheyenne River at the mouth of Indian Creek (Williams and Wilcox, August, 1891).

In moist, alkaline soils.

Bouteloua racemosa Lag.

North Dakota: Minot (Brannon 107), Merrifield, Dickinson, Jamestown, Oakes.

South Dakota: Brookings (Wilcox 3, 4), Redfield (Griffiths 67), Aberdeen (Griffiths 83, 134), Frankfort (Griffiths 61), Huron (Griffiths 18), Firesteel Creek (Wilcox), Medicine Horse Creek (Wallace 10), Indian Creek (Wallace 9).

Dry prairies and hillsides.

Bouteloua hirsuta Lag.

South Dakota: Brookings, Sioux Falls, Iroquois, Aurora County (Wilcox 41).

Dry soil of rocky knolls.

Bouteloua oligostachya Torr.

North Dakota: Minot (Brannon 104), Dickinson (Brannon 133), Devil's Lake, Church's Ferry, Bottineau, Jamestown, Grand Forks, Oakes, Bismarck.

South Dakota: Brookings (Wilcox 1, 2), Aberdeen (Griffiths 137), Pierre (Griffiths 26), Huron, Sioux Falls, Salem, White River (Wallace 20, 47), Aurora County (Wilcox).

Bulbilis dactyloides (Nutt.) Rafin.

North Dakota: More or less abundant along the Northern Pacific Railroad west of Jamestown.

South Dakota: Aberdeen (Griffiths 122), Redfield (Griffiths 66), Huron (Griffiths 11), Highmore (Griffiths 46), Firesteel Creek (Wilcox), Medicine Root Creek (Wallace 11), White River (Wallace 48), Aurora County (Wilcox 43), Iroquois (Wilcox 42).
Dry prairies.

FESTUCACEÆ.

Munroa squarrosa Torr.

South Dakota: Pierre (Griffiths 24), Little White River (Wallace 8), Cheyenne River (Wallace 7).
Dry, sandy soil.

Phragmites vulgaris Trin.

North Dakota: Church's Ferry (Brannon 60), Minnewaukon, Minot, Sweet Briar.
South Dakota: Brookings, Redfield (Griffiths 73), Canning (Griffiths 105), Aurora County (Wilcox).
Wet, sandy soil, along margins of streams and lakes.

Leptochloa fascicularis Gray.

South Dakota: Brookings, Aberdeen (Griffiths 111), Aurora County, along Firesteel Creek (Wilcox 7).
Margins of brackish pools.

Eragrostis major Host.

South Dakota: Brookings, Aberdeen (Griffiths 117), Pierre (Griffiths 23, 37), Sioux Falls, White River (Wallace 22).
Fields and waste places.

Eragrostis pectinacea spectabilis (Pursh) Gray.

Iowa: Waupsipinicon River (Wilcox 29).

Eragrostis purshii Schrad.

South Dakota: Brookings, Huron, Plankinton (Wilcox 9).
Fields and waste places.

Eragrostis reptans Nees.

South Dakota: Brookings, Aurora County (Wilcox 46), Aberdeen (Griffiths 140), Huron.

Banks of streams and dried-up ponds. The Aurora County specimens are more or less pubescent and have the spikelets in capitate cluster. They apparently belong to the var. *capitata* of Nuttall.

Eatonia nitida (Sprengl.) Nash. (*E. dudleyi* Vasey).

North Dakota: Grand Forks (Brannon 11).

Eatonia obtusata Gray.

North Dakota: Dunseith (Brannon 95).
South Dakota: Brookings (Wilcox 60), Aurora County (Wilcox), Rosebud (Wallace 25), White River (Wallace 58), Indian Creek (Wallace 59), Sioux Falls.
Rather dry bottom lands.

Eatonia pennsylvanica Gray.

North Dakota: Pleasant Lake (Brannon 75).
South Dakota: Brookings, Sioux Falls.
Open woods.

Koeleria cristata Pers.

North Dakota: Grand Forks (Brannon 14), Devil's Lake, Langdon, Bottineau, Church's Ferry, Minot, Dickinson, Oakes, Jamestown, Fargo.

South Dakota: Brookings (Wilcox 37), Plana (Griffiths 131), Huron (Griffiths 1), buttes along the Keya Paha (Wallace 26), Rosebud (Wallace 27), White Clay buttes (Wallace 60), Sioux Falls, Salem, Iroquois, Aurora County (Wilcox 39).
Dry prairies.

Catabrosa aquatica Beauv.

South Dakota: White River (Wallace 23).
Wet, marshy ground.

Melica hallii Vasey.

North Dakota: Langdon (Brannon 45), Dunseith (Brannon 100).
In dry soil of high, rolling prairies.

Distichlis spicata stricta Thurb.

North Dakota: Church's Ferry (Brannon 62), Grand Forks, Bad Lands west of the Missouri River.

South Dakota: Brookings, Rondell (Griffiths 128), Aberdeen (Griffiths 112), Iroquois, Huron, Aurora County (Wilcox 36), White River (Wallace 6), Bad Lands along Cheyenne River (Wallace 57).
Saline soil.

Dactylis glomerata Linn.

North Dakota: Red River Valley.
South Dakota: Brookings, Sioux Falls.
Cultivated, and occasionally escaped.

Poa arida Vasey.

North Dakota: Merrifield (Brannon 19), Oakes.
South Dakota: Brookings, Aurora County (Wilcox 32), Huron, Iroquois.
Moist ground.

Poa buckleyana Nash.

North Dakota: Merrifield (Brannon 24), Dickinson (Brannon 120), Devil's Lake, Church's Ferry.
South Dakota: Bad Lands along White River (Wallace).
In dry soil of prairies and tops of buttes, forming dense bunches.

Poa compressa Linn.

South Dakota: Brookings, Highmore (Griffiths 47), James River Valley, Iroquois, Chamberlain, Brown County.
Dry soil, cultivated, and some forms apparently indigenous.

Poa nemoralis Linn.

North Dakota: Langdon (Brannon 39), Conway (Brannon 33), Dickinson (Brannon 126).
South Dakota: Big Stone, Lake Hendricks, Brookings, Sioux Falls, Canning, Battle Creek (Wallace 19), Sand Lake.
In dry soil. Nos. 33 and 126 of Professor Brannon's collection belong to the form known as *Poa caesia strictior* Gray.

Poa nevadensis Vasey.

North Dakota: Grand Forks (Brannon 16).
In low but rather dry meadows.

Poa pratensis Linn.

North Dakota: Grand Forks (Brannon 2, 17, 42), Langdon (Brannon 43), Inkster, Oakes, Fargo, Church's Ferry.
South Dakota: Big Stone, Brookings, Sioux Falls, Aurora County, Huron, Aberdeen.
Cultivated, and also occurring wild in moist prairie meadows.

***Poa flava* L. (*Poa serotina* Ehrh.)**

North Dakota: Grand Forks (Brannon 13), Inkster (Brannon 32), Minnewaukon (Brannon 67), Church's Ferry (Brannon 73), Willow City (Brannon 83).

South Dakota: Brookings, Sioux Falls, Blunt, Lake Hendricks, Aberdeen (Griffiths 114).

In both dry and moist soils. The specimens from Minnewaukon grew in a dry alkaline meadow.

***Glyceria airoides* (Nutt.) Gray.**

North Dakota: Minnewaukon (Brannon 71), Medora (Brannon 136), Grand Forks, Inkster, Mandan.

South Dakota: throughout the Bad Lands region.

In moist, alkaline soils.

***Glyceria aquatica* J. E. Smith.**

North Dakota: Monroe (Brannon 110), Grand Forks.

South Dakota: Brookings, Aurora County, Frankfort (Griffiths 50), Medicine Horse Creek (Wallace 29).

Shallow water.

***Glyceria fluitans* R. Br.**

South Dakota: Brookings (Wilcox 66), and elsewhere in the Sioux Valley.

In shallow water.

***Glyceria nervata* Trin.**

South Dakota: Brookings (Wilcox 18), Sioux Falls, Aurora County, White River (Wallace 62), Bear Creek (Wallace 21).

In wet, boggy meadows or shallow water.

***Scolochloa arundinacea* (Lilj.) MacM.**

North Dakota: Webster's Chapel (Brannon 57).

South Dakota: Brookings.

Shallow water, apparently quite local in distribution.

***Festuca elatior* Linn.**

South Dakota: Brookings, Mellette (Griffiths 145).

Cultivated, and escaping here and there along roadsides.

***Festuca elatior pratensis* Gray.**

South Dakota: Brookings, Mellette (Griffiths 146).

Cultivated, and occasionally escaping.

***Festuca octoflora* Walt.**

North Dakota: A few specimens mixed with a miscellaneous lot of material collected at Langdon and Inkster.

South Dakota: Brookings, Sioux Falls, Aurora County (Wilcox 65).

Dry soil on rocky hills.

***Bromus ciliatus* Linn.**

North Dakota: Bottineau (Brannon 84, 92), Grand Forks, Girard Lake.

South Dakota: Big Stone, Brookings, Sioux Falls, Iroquois, Aurora County, Redfield (Griffiths 74).

In dry soil of open woods.

***Bromus inermis* Leyss.**

South Dakota: Brookings, Mellette (Griffiths 143), Aurora County (Wilcox), Beadle County.

Cultivated, and spreading into roadsides and fields.

Bromus kalmii Gray.

North Dakota: Bottineau (Brannon 79, 87).
In open woods.

HORDEÆ.

Agropyron caninum R. & S.

South Dakota: Brookings (Wilcox 22), Iroquois, Huron.
Dry fields and roadsides.

Agropyron divergens Nees.

North Dakota: Dickinson (Brannon 123).
South Dakota: Bad Lands along Indian Creek (Williams and Wilcox, August, 1891).
Dry hillsides and tops of buttes.

Agropyron pseudorepens Scribn. & Smith. Bull. 4, Div. Agros., p. 34 (1897).

North Dakota: Medora (Brannon 127), Grand Forks, Inkster, Oakes.
South Dakota: Brookings, Frankfort (Griffiths 55), Huron, Pierre (Griffiths 106),
Cheyenne River (Wallace 55).
In rich but rather dry soil.

Agropyron richardsoni Schrad. (*A. unilaterale* Cass.)

North Dakota: Dickinson (Brannon 131), Willow City, Oakes.
South Dakota: Brookings (Wilcox 72), Le Beau, Chamberlain.
Dry prairie soil.

Agropyron spicatum (Pursh) Scribn. & Smith, Bull. 4, Div. Agros., p. 33. (*Agropyrum repens* var. *glaucum* of the manuals.)

North Dakota: Willow City (Brannon 78), Church's Ferry, Inkster, Edinburg, Devil's Lake, Oakes, Fargo.
South Dakota: Brookings, Huron (Griffiths 17), Aberdeen (Griffiths 81), St. Lawrence (Griffiths 41), Sioux Falls, Salem, Aurora County (Wilcox 19), White River (Wallace 44, 51, 52).
In dry soil of prairies, roadsides, and neglected fields.

Agropyron tenerum Vasey.

North Dakota: Dickinson (Brannon 128), Church's Ferry, Oakes.
South Dakota: Brookings (Wilcox 45), Huron (Griffiths 5, 16), Frankfort (Griffiths 62), Redfield (Griffiths 69), Aurora County, Canning, White River (Wallace 53), Chamberlain, Bangor, Indian Creek.
Dry bottom lands, along roadsides, and in neglected fields.

Hordeum jubatum L.

North Dakota: Dickinson (Brannon 117), Oakes, Fargo, Jamestown, Mandan.
South Dakota: Brookings, Sioux Falls, Salem, Aurora County (Wilcox), Huron (Griffiths 13), Aberdeen (Griffiths 85), White River (Wallace 54).
Waste places in fields, along irrigating ditches, and in meadows. Abundant throughout the Northwest.

Hordeum nodosum L.

South Dakota: Sioux Falls.
Margins of desiccated ponds, particularly where the soil is somewhat alkaline.

Elymus canadensis L.

North Dakota: Minnewaukon (Brannon 66), Devil's Lake, Minot, Grand Forks, Dickinson, Oakes, Fargo.
South Dakota: Brookings (Wilcox 63), Sioux Falls, Redfield (Griffiths 75), Frankfort (Griffiths 64), Pierre (Griffiths 27, 33), Aurora County (Wilcox 24), White River (Wallace 16), Indian Creek (Wallace 17).
In rather dry soil of open woods, meadows, and neglected tree claims.

Elymus macounii Vasey.

North Dakota: Minot (Brannon 106), Grand Forks.

South Dakota: Brookings, Big Stone, Frankfort (Griffiths 63), Huron (Griffiths 4).

Dry bottom lands and neglected tree claims.

Elymus robustus Scribn. & Smith, Bull. 4, Div. Agros., p. 37 (1897).

South Dakota: Mellette (Griffiths 139).

Elymus striatus Willd.

South Dakota: Brookings (Wilcox 68).

Open woodlands.

Elymus virginicus L.

North Dakota: Minot (Brannon 114), Bottineau, Oakes.

South Dakota: Brookings (Wilcox 5), Sioux Falls, Redfield (Griffiths 76), Aurora County, White River (Wallace 45), Indian Creek (Wallace 18).

Elymus sp.

North Dakota: Bottineau (Brannon 85).

Dry soil along the edges of thickets. "The heads bend downward shortly after the flowering season" (Brannon).

TYPHACEÆ.**Typha latifolia** L.

South Dakota: Aberdeen (Griffiths 126).

Becoming very abundant in the water from the artesian wells.

CYPERACEÆ.**Cyperus acuminatus** Torr. & Hook.

South Dakota: Frankfort (Griffiths 57).

Dry ditches.

Cyperus erythrorhizos Muhl.

South Dakota: Brookings, Sioux Falls, Iroquois, Tacoma Park on the James River (Griffiths 97).

Cyperus schweinitzii Torr.

North Dakota: Rugby Junction (Brannon 97).

South Dakota: Rock Ridge Creek (Wallace 74), Rosebud (Wallace 75), Medicine Root Creek (Wallace 76).

In dry sandy soil.

Cyperus speciosus Vahl.

South Dakota: Huron (Griffiths 9).

Moist, shady places.

Eleocharis acicularis R. & S.

North Dakota: Pleasant Lake (Brannon 74).

South Dakota: Brookings, Dell Rapids, Brady Creek (Wallace 73).

Growing in dense mats along the banks of ponds or streams.

Eleocharis acuminata (Muhl.) Nees.

North Dakota: Conway (Brannon 35).

South Dakota: Brookings.

Wet, boggy soil.

Eleocharis palustris L.

North Dakota: Girard Lake (Brannon 103).

South Dakota: Brookings, Sioux Falls, Big Stone.

In low, wet ground or shallow water.

Scirpus americanus Pers. (*S. pungens* Vahl.)

South Dakota: Brookings, Redfield (Griffiths 80), Aberdeen (Griffiths 115a, b, c), Rosebud (Wallace 71).

Moist soil and margins of lakes, ponds, and along irrigating ditches. Mr. Griffiths' specimens from Aberdeen show the variation of the species under different conditions of soil moisture. No. 115c, which grew in the water of an irrigating ditch, seems to be variety *longispicatus* Britt., but the plants are immature.

Scirpus atrovirens Muhl.

South Dakota: Brookings, Sioux Falls, Iroquois, Rock Ridge Creek (Wallace 69). Wet, boggy land.

Scirpus atrovirens pallidus Britt.

North Dakota: Grand Forks (Brannon 31).

South Dakota: Bear Creek (Wallace 72).

Wet, boggy land.

Scirpus fluviatilis Gray.

North Dakota: Grand Forks (Brannon 25).

South Dakota: Brookings, Sioux Falls, Aurora County (Wilcox), Aberdeen (Griffiths 119), Redfield (Griffiths 72), Huron (Griffiths 2).

Shallow water. Very common along the borders of lakes throughout the Northwest and spreading very rapidly along irrigating ditches and about reservoirs.

Scirpus lacustris L.

North Dakota: Grand Forks (Brannon 15), Dunseith (Brannon 94), Devil's Lake, Fargo, Oakes, Jamestown.

South Dakota: Big Stone, Lake Hendricks, Brookings, Sioux Falls, Running Water, Blunt, Aberdeen (Griffiths 102, 110), Aurora County (Wilcox), Rosebud (Wallace, 70).

In shallow water of sloughs and along lake shores.

Scirpus robustus Pursh.

North Dakota: Minnewaukon (Brannon 69), Grand Forks.

South Dakota: Brookings, Iroquois, Aberdeen (Griffiths 109), Miller (Griffiths 44), Aurora County (Wilcox).

In brackish water of shallow lakes and along irrigating ditches.

Rhynchospora capillacea Torr.

North Dakota: Bottineau (Brannon 89).

In dense mats on boggy ground.

Carex aristata R. Br.

North Dakota: Girard Lake (Brannon 102a).

South Dakota: Brookings, Tacoma Park (Griffiths 99), Plana (Griffiths 84), Aberdeen (Griffiths 93).

Wet, boggy land.

Carex assinniboiensis W. Boott (?)

South Dakota: Oakwood Lakes (Griffiths 88).

Woodlands.

Carex festucacea Willd.

North Dakota: Minot (Brannon 116a), Oakes.

South Dakota: Brookings.

Sloughs.

Carex filifolia Nutt.

South Dakota: Top of Sheep Mountain in the Bad Lands near Cheyenne River (Wallace 75).

Carex flava L.

North Dakota: Bottineau (Brannon 90).
In boggy ground.

Carex haydeni Dewey.

South Dakota: Tacoma Park (Griffiths 99b).
Sloughs.

Carex lanuginosa Michx.

North Dakota: Girard Lake (Brannon 102b), Oakes.
South Dakota: Brookings, Iroquois, Aurora County.
Moist, boggy land.

Carex laxiflora blanda (Dewey) Beott.

South Dakota: Oakwood Lakes (Griffiths 87).
Open woods.

Carex meadii Dewey.

North Dakota: Langdon (Brannon 37), Oakes.
South Dakota: Brookings.
Moist soil.

Carex pennsylvanica Lam. (?).

North Dakota: Grand Forks (Brannon 29).
Dry soil. Specimens immature.

Carex retrorsa Schwein.

South Dakota: Brookings, Flandreau, Aurora County.
Wet, boggy meadows.

Carex sartwellii Dewey.

North Dakota: Grand Forks (Brannon 8, 27, 70).
In sloughs and moist meadows. Nos. 8 and 27 are staminate and immature.

Carex siccata Dewey.

South Dakota: Brookings, Aurora County (Wilcox).
Rather dry meadows.

Carex stipata Muhl.

South Dakota: Rosebud (Wallace 75).

Carex stricta Lam.

North Dakota: Grand Forks (Brannon 9), Oakes.
South Dakota: Brookings, Sioux Falls, Aurora County (Wilcox).
Wet, boggy meadows.

Carex stricta angustata Bailey.

North Dakota: Girard Lake (Brannon 102c).
South Dakota: Brookings.
Low, damp ground.

Carex tenera Dewey.

North Dakota: Minot (Brannon 116b).
South Dakota: Brookings.
Sloughs.

Carex vulpinoidea Michx.

South Dakota: Brookings, Chamberlain, White River (Wallace 74).
Meadows.

Carex xerantica Bailey.

North Dakota: Devil's Lake (Brannon 52).

South Dakota: Tacoma Park (Griffiths 98).

Rather dry soil.

JUNCACEÆ.**Juncus balticus** Willd.

North Dakota: Dunseith (Brannon 93), Knox, Grand Forks.

South Dakota: Brookings.

In wet bottom lands.

Juncus bufonius L.

South Dakota: White River (Wallace 65).

Wet, boggy places.

Juncus nodosus L.

North Dakota: Dickinson (Brannon 121).

South Dakota: Brookings, Iroquois, Sioux Falls.

Low ground.

Juncus tenuis Willd.

North Dakota: Minot (Brannon 109).

South Dakota: Brookings, head of White Willow Creek (Wallace 67), Rosebud (Wallace 68).

In low, moist ground.

Juncus torreyi Coville.

North Dakota: Minnewaukon (Brannon 68), Devil's Lake (Brannon 51).

South Dakota: Brookings, Iroquois, Medicine Root Creek (Wallace 66).

Wet meadows.

IRIDACEÆ.**Sisyrinchium angustifolium** Mill.

North Dakota: Grand Forks (Brannon 3), Langdon, Devil's Lake.

South Dakota: Brookings, Aurora County (Wilcox), Aberdeen (Griffiths 101), Sioux Falls.

POLYGONACEÆ.**Polygonum aviculare** L.

North Dakota: Oakes, Fargo, Jamestown.

South Dakota: Brookings, Sioux Falls, Huron, Aberdeen, Aurora County (Wilcox).

Dry soil in waste places and roadsides. Common everywhere in the Northwest.

Polygonum erectum L.

South Dakota: Brookings, Sioux Falls, Aurora County (Wilcox).

Fields and waste places.

Polygonum littorale Link.

South Dakota: Brookings.

Old fields and roadsides.

CHENOPODIACEÆ.**Chenopodium album** L.

North Dakota: Oakes, Jamestown, Fargo.

South Dakota: Brookings, Huron, Iroquois, Sioux Falls, Aberdeen, Aurora County (Wilcox).

Fields and waste places. Abundant throughout.

Chenopodium leptophyllum (Moq.) Nutt.

South Dakota: Brookings, Huron, Iroquois, Aurora County (Wilcox 73).

Atriplex argenteum Nutt.

South Dakota: Pierre, Aurora County (Wilcox), White River.
In "gumbo" soil.

Atriplex hastatum L.

South Dakota: Brookings, Sioux Falls, Iroquois, Aberdeen, Aurora County (Wilcox).
Waste places in saline soils, "gumbo flats," etc.

Eurotia lanata Moq.

Dry "alkali" soil in central and western South Dakota.

Salsola tragus L.

More or less abundant in both the Dakotas.

LEGUMINOSÆ.**Medicago sativa** L.

Frequently seen in cultivation in both States.

Melilotus alba Lam.

North Dakota: Southern slope of the Turtle Mountains (Brannon).
South Dakota: Brookings, Mellette (Griffiths 155), Sioux Falls, Brown County.
Cultivated, and also escaped to roadsides, railroad embankments, and waste places.

Melilotus officinalis Willd.

North Dakota: Turtle Mountains (Brannon), Fargo.
South Dakota: Brookings, Sioux Falls.
Cultivated, and occasionally escaped to waste places, etc.

Lupinus luteus L.

South Dakota: Brookings, Mellette (Griffiths 149).
Cultivated; thriving in sandy soil.

Trifolium beckwithii Brewer.

South Dakota: Brookings.
Moist meadows.

Trifolium hybridum L.

North Dakota: Grand Forks (Brannon 21), Church's Ferry, Hillsboro, Fargo.
South Dakota: Brookings, Aberdeen, Mellette (Griffiths 150), Sioux Falls, Aurora County.
Cultivated, and escaped to roadsides and meadows.

Trifolium pratense L.

North Dakota: Church's Ferry (Brannon 58), Grand Forks, Devil's Lake, Fargo, Jamestown.
South Dakota: Brookings, Millbank, Sioux Falls, Watertown, Aberdeen, Mellette (Griffiths 151, 152), Plankinton (Wilcox), Huron, Miner County.
Cultivated, and escaped to moist meadows, roadsides, and ditches.

Trifolium repens L.

North Dakota: Oakes, Fargo, Jamestown.
South Dakota: Brookings, Millbank, Sioux Falls, Salem, Huron, Aberdeen, Aurora County, Watertown, Miner County.
Cultivated in pastures and dooryards, and escaped to roadsides and waste places.

Hosackia purshiana Benth.

North Dakota: Medora (Brannon 124), Dickinson, Minot, Fort Totten, Langdon, Grand Forks, Oakes, Jamestown, Mandan.
South Dakota: Brookings, Aberdeen (Griffiths 92), Pierre, Chamberlain, Huron, Aurora County (Wilcox), Redfield.

Sandy soil, abundant in the valleys of the James and Missouri rivers, and more or less common throughout both States.

***Psoralea argophylla* Pursh.**

Prairies throughout the Northwest.

***Psoralea esculenta* Pursh.**

Sandy or gravelly soil throughout.

***Dalea alopecuroides* Willd.**

South Dakota: Aurora County (Wilcox).

Sandy soil. Abundant in the lower Missouri Valley.

***Astragalus adsurgens* Pall.**

North Dakota: Bottineau (Brannon 86), Oakes.

South Dakota: Brookings, Aberdeen, Huron, Salem, Iroquois, Aurora County (Wilcox 83).

In dry soil on high prairies.

***Astragalus bisulcatus* Gray.**

North Dakota: Manvel (Brannon 1), Grand Forks.

South Dakota: Bad Lands between the White and Cheyenne rivers.

***Astragalus canadensis* L.**

South Dakota: Brookings (Wilcox 81), Iroquois, Sioux Falls, Aurora County (Wilcox).

***Astragalus caryocarpus* Ker.**

North Dakota: Minot (Brannon 105), Dickinson, Grand Forks, Oakes.

South Dakota: Brookings (Wilcox 79), Watertown, Sioux Falls, Aberdeen, Huron, Aurora County (Wilcox).

Dry soil on rolling prairies.

***Astragalus flexuosus* Dougl.**

North Dakota: Grand Forks (Brannon 6), Devil's Lake.

South Dakota: Brookings, Aurora County (Wilcox), McPherson County, Iroquois, Lake Hendricks (Wilcox 80).

Dry prairies.

***Astragalus hypoglottis* L.**

North Dakota: Grand Forks (Brannon 7), Inkster, Oakes, Jamestown.

South Dakota: Brookings (Wilcox 82), Salem, Huron, Watertown, Aberdeen, Aurora County (Wilcox).

Dry prairies and banks of coulees.

***Astragalus missouriensis* Nutt.**

South Dakota: Aurora County (Wilcox 77).

Prairies.

***Astragalus plattensis* Nutt.**

South Dakota: Aurora County (Wilcox), Salem (Wilcox 78).

Sandy soil.

***Oxytropis lambertii* Pursh.**

North Dakota: Inkster (Brannon 36), Langdon, Devil's Lake, Grand Forks, Oakes, Jamestown.

South Dakota: Brookings, Sioux Falls, Iroquois, Watertown, Aberdeen, Redfield, Aurora County (Wilcox).

Dry soil on high prairies.

Desmodium canadense D. C.

North Dakota: Fort Totten (Brannon 53), Edinburg, Grafton.

South Dakota: Brookings, Sioux Falls, Iroquois.

Rich soil on the borders of woods, etc.

Vicia americana Muhl.

North Dakota: Inkster (Brannon 5), Grand Forks (Brannon 47), Manvel.

South Dakota: Brookings (Wilcox 85), Sioux Falls, Iroquois, Aurora County (Wilcox).

Moist meadows and thickets.

Vicia americana linearis Watson.

North Dakota: Manvel (Brannon 22).

South Dakota: Brookings, Iroquois, Watertown, Salem, Big Stone.

Dry fields and meadows.

Vicia villosa Roth.

South Dakota: Brookings, Mellette (Griffiths 154).

Cultivated, and rarely as an escape.

Vigna catjang Walp.

South Dakota: Brookings, Mellette (Griffiths 153).

Cultivated.

Lathyrus palustris L.

North Dakota: Merrifield (Brannon 20), Grand Forks, Inkster.

South Dakota: Brookings, Sioux Falls, Iroquois.

Moist meadows, banks, and ditches.

Lathyrus venosus Muhl.

North Dakota: Union (Brannon 44), Edinburg.

South Dakota: Brookings, Lake Hendricks.

In rich soil of meadows and thickets, climbing to a height of 4 to 8 feet, and producing a dense tangled growth.

BULLETIN No. 7, REVISED EDITION.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF AGROSTOLOGY.

[Grass and Forage Plant Investigations.]

AMERICAN GRASSES—I.

(ILLUSTRATED.)

BY

rank
F. LAMSON-SCRIBNER,
AGROSTOLOGIST.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1898.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF AGROSTOLOGY,
Washington, D. C., April 22, 1898.

SIR: I submit herewith copy for a new and revised edition of Bulletin No. 7 of this division and recommend its publication. This bulletin contains 302 illustrations of native and introduced grasses, accompanied by brief descriptions and notes upon the distribution of each. The law governing the publications of this Department limited the first edition of Bulletin No. 7 to 1,000 copies, which was quickly exhausted; and as applications for it are continually being received, a new edition is necessary to meet this demand. There are also some slight revisions and corrections necessary to bring the work up to date. Manuscript for a similar bulletin illustrating over 300 additional species is now ready for the press, and when published can be bound with No. 7, which may be treated as Part I of "American Grasses Illustrated." Notes upon the use and value of the species of economic interest were published in Bulletin No. 3 of this division, "Useful and Ornamental Grasses."

The drawings are all from carefully selected specimens, the habit sketches being made by Mr. A. H. Baldwin. The enlarged details were drawn by myself, with the exception of a few which were made by Miss M. D. Baker. The engraving is the work of Mr. L. S. Williams and Mr. George P. Bartle. The work has all been done in the office of the division, with the exception of that performed by Mr. Bartle.

Respectfully, F. LAMSON-SCRIBNER,
Agrostologist.

Hon. JAMES WILSON,
Secretary of Agriculture.

INTRODUCTION.

In order to make the present publication more useful to students of grasses, the order Gramineæ and the several tribes into which the order has been divided by our best authorities are here briefly characterized. Under the tribes the genera which are native or have been introduced are enumerated, and those having species figured in this bulletin are marked with an asterisk (*).

GRAMINEÆ—GRASSES.

Characters of the order.—Fibrous-rooted, annual or perennial, herbaceous (rarely woody) plants, with usually hollow, cylindrical (rarely flattened) and jointed stems (*culms*) whose internodes for more or less of their length are enveloped by the sheath-like basal portion of the two-ranked and usually linear, parallel-veined leaves; flowers without any distinct perianth, hermaphrodite or rarely unisexual, solitary or several together, in *spikelets*, which are arranged in panicles, racemes, or spikes, and which consist of a shortened axis (the *rachilla*) and two or more chaff-like, distichous imbricated bracts (*glumes*), of which the first two, rarely one or none or more than two, are empty (*empty glumes*); in the axil of each of the succeeding bracts (excepting sometimes the uppermost) is borne a flower (hence these are named *flowering glumes*). Opposed to each flowering glume, with its back turned toward the rachilla, is (usually) a two-nerved, two-keeled bract or prophyllum (the *palea*), which frequently envelops the flower by its infolded edges. At the base of the flower, between it and its glume, are usually two very small hyaline scales (*lodicules*);

rarely there is a third lodicule between the flower and the palea; stamens, usually three (rarely two or one, or more than three) with very slender filaments and two-celled, usually versatile anthers; pistil with a one-celled, one-ovuled ovary, and one to three, usually two, styles with variously branched, most frequently plumose, stigmas; embryo small, lying at the front and base of the seed, covered only by the thin pericarp; fruit a caryopsis, rich in albumen. (In *Sporobolus* and *Eleusine* the thin pericarp is free from the seed.)

Number of species.—There are about thirty-five hundred known species of grasses, varying in size from the moss-like *Coleanthus* of the North to the tree-like bamboos of the Tropics, which tower to the height of 30 m. or more; and ranging in distribution from Kerguelen Land on the South to the extreme limit of vegetation beyond the Arctic Circle. There is no order of plants more widely distributed, or existing under a greater diversity of soil and climate, and no other order presents such a vast number of individual plants or is so important and directly useful to man.

SERIES A.—PANICACEÆ.

Spikelets one- rarely two-flowered; when two-flowered the second or terminal one is perfect, the first or lower one being either staminate or neuter; rachilla articulated below the empty glumes, the spikelets falling from the pedicels entire, either singly, in groups, or together with the joints of an articulate rachis. The first six tribes belong to this series.

TRIBE I.—*Maydeæ*.

Spikelets unisexual, the staminate forming a part of the inflorescence with the pistillate, or each in a separate inflorescence on the same plant; flowering glumes hyaline or much less firm in texture than the outer ones; axis of the female spikelets usually articulated.

This is a small tribe, numbering only sixteen species classed in seven genera. They are nearly all natives of the Tropics, chiefly in the Old World. Indian corn, or maize, is our best known example of the Maydeæ.

Euchlæna Schrad.

Zea Linn.

Tripsacum Linn.*

TRIBE II.—*Andropogoneæ*.

Spikelets in spike-like racemes, two at each joint of the articulate rachis, one sessile and hermaphrodite, one pedicellate, the latter hermaphrodite, staminate, neuter, or reduced to the pedicel alone; glumes usually four, the first and second empty, larger and much firmer in texture than the others, the third usually empty, with a staminate flower in its axil, very rarely awned, the fourth or flowering glume hyaline, usually awned, awn usually twisted or geniculate.

This tribe contains about four hundred species divided among twenty-nine genera, of which the genus *Andropogon*, with one hundred and ninety species, is by far the largest and probably the most important. Sugar cane belongs to this tribe in the genus *Saccharum*. Our best known representatives of the *Andropogoneæ* are the common broom sedge, *Andropogon virginicus*, and the big blue stem, *Andropogon provincialis*. In the same genus are now classed our species of sorghum. The members of the tribe are distributed throughout the tropical and warmer regions of both hemispheres.

Imperata Cyr.*

Miscanthus Anderss.

Saccharum Linn.

Erianthus Michx.*

Manisuris Linn.*

(*Rottboellia* Linn. f.)

Hackelochloa Kuntze.*

(*Manisuris* Sw. not Linn.)

Trachypogon Nees.

Elionurus HBK.*

Andropogon Linn.*

TRIBE III.—*Zoysieæ*.

Spikelets solitary or in groups of two to eight, each group falling as a whole from the continuous rachis, usually one-flowered, hermaphrodite, or staminate and hermaphrodite in the same group; flowering glume less firm in texture than the awned or awnless outer ones, which are herbaceous, chartaceous, or coriaceous; the first glume is usually larger than the second.

A small tribe, numbering about twenty-five species which represent nearly half that number of genera. Fifteen species are natives of the tropical and warmer temperate regions of America. Black grama, or *Galleta*, as the Mexicans name it, species of *Hilaria*, are our best-known representatives of the tribe.

Hilaria Kunth.*
Ægopogon HBK.

Nazia Adans. (*Tragus* Hall).
Zoysia Willd.

TRIBE IV.—*Tristegineæ*.

Spikelets all hermaphrodite, in panicles; empty glumes three, or the third with a staminate flower in its axil, herbaceous or chartaceous; flowering glumes membranaceous, awned or awnless; rachilla articulated below the empty glumes.

A small tribe of only seven genera and thirty-three species, natives chiefly of the tropical regions of the Old World. Of the few American species none extend so far north as the United States.

TRIBE V.—*Paniceæ*.

Spikelets hermaphrodite, terete or flattened on the back; glumes three or four (rarely only two); when four there is occasionally a staminate flower or a palea in the axil of the third; the uppermost or flowering glume of the hermaphrodite flower is always firmer in texture than the outer glumes, of which the first is usually smaller than the others; axis of the inflorescence not articulated, the rachilla being articulated below the empty glumes, the spikelets falling off singly from their pedicels.

This is one of the largest tribes in the order Gramineæ. It contains twenty-two genera with over six hundred and thirty species. *Panicum*, the principal genus, is the largest among grasses, numbering three hundred species. The *Paniceæ* are very widely distributed throughout the tropical and temperate regions of the world. Crab-grass and the millets are among our best known examples of this tribe.

Reimaria Flügge.*	Oplismenus Beauv.
Paspalum Linn.*	Chaetochloa Scribn.*
Anthænantia Beauv.	(<i>Setaria</i> Auct.)
Amphicarpon Raf.*	Cenchrus Linn.*
Eriochloa Kunth.*	Pennisetum Pers.*
Panicum Linn.*	Stenotaphrum Trin.*

TRIBE VI.—*Oryzæ*.

Spikelets usually much compressed laterally, one-flowered, staminate, pistillate, or hermaphrodite; empty glumes two or none, the flower being subtended by the floral glume and palea alone, the latter one-nerved and regarded by some as a second glume; stamens frequently six; axis of the inflorescence not articulated.

A small tribe of about forty species divided among sixteen genera, mostly confined to tropical America. One of the best known and most extensively used of the cereals, rice (*Oryza sativa*), belongs here.

Hydrochloa Beauv.	Zizania Linn.
Pharus Linn.	Oryza Linn.
Luziola Juss.*	Homalocenchrus Mieg.*
Zizaniopsis Doell and Asch.	(<i>Leersia</i> Sw.)

SERIES B.—POACEÆ.

Spikelets one- to many-flowered, the imperfect or rudimentary flower, if any, usually uppermost; rachilla

usually articulated above the empty glumes, so that these remain after the fall of the fruiting glume.¹ In spikelets with two or more flowers these are separated by a manifest internode of the rachilla, and in such cases the rachilla is usually articulated below each flowering glume.

TRIBE VII.—*Phalarideæ*.

Spikelets more or less laterally compressed, one- or rarely three-flowered; glumes five, the first two empty and below the articulation of the rachilla, the third and fourth above the articulation, usually empty, very unlike the outer ones, rarely subtending staminate flowers, sometimes reduced to mere bristles, the fifth glume with a one-nerved or nerveless palea and a hermaphrodite flower.

A small tribe, comprising six genera with about sixty species of comparatively little importance. Several of the species, sweet vernal grass and vanilla grass, are remarkable for possessing a peculiar fragrance due to their containing coumarin. Canary-grass is one of the best known members of this tribe.

Phalaris Linn.*

Savastana Schrank.*

Anthoxanthum Linn.*

(*Hierochloë* Gmelin).

TRIBE VIII.—*Agrostideæ*.

Spikelets all hermaphrodite, one-flowered with three glumes, the first two empty (very rarely wanting), usually as long as or exceeding the third or floral glume; rachilla sometimes prolonged behind the palea into a naked or plumose bristle. Palea two-nerved (one-nerved in *Cinna*), nerveless, or (in some *Agrostis* species) wanting.

¹ *Alopecurus*, *Cinna*, *Spartina*, and *Holcus* among our grasses, have the rachilla articulated below the first pair of glumes, and the spikelets fall off entire.

This is, next to the *Festuceæ*, the largest tribe in the order, numbering seven hundred species arranged in forty-six genera. The species are distributed throughout all the temperate and colder regions of the world and many occur within the Tropics. The genus *Agrostis*, from which the tribe derives its name and from which comes the word "agrostologist," has about one hundred species, found in all parts of the world, especially in the north temperate zone. Some of our most important meadow grasses—notably Herd's-grass and timothy—belong to this tribe.

Aristida Linn.*	Sporobolus R. Br.*
Stipa Linn.*	Epicampes Presl.*
Oryzopsis Michx.*	Polypogon Desf.
Eriocoma.*	Limnodia L. H. Dewey.*
Milium Linn.*	(<i>Thurberia</i> Benth.)
Muhlenbergia Schreb.*	Arctagrostis Griseb.
Brachyelytrum Beauv.*	Cinna Linn.*
Lycurus Kunth.	Agrostis Linn.*
Pereilema Presl.	Gastridium Beauv.
Heleochloa Host.*	Calamagrostis Roth.*
Phleum Linn.*	Ammophila Host.*
Alopecurus Linn.*	Calamovilfa Scribn.*
Coleanthus Seid.	Apera Adans.
Phippsia R. Br.*	Lagurus Linn.

TRIBE IX.—*Aveneæ*.

Spikelets two- to several-flowered; outer empty glumes usually longer than the first floral glume; one or more of the floral glumes awned on the back or from between the teeth of the bifid apex; awn usually twisted or geniculate; the callus, and usually the joints of the rachilla, hairy.

A tribe comprising twenty-three genera and over three hundred species widely distributed in the temperate regions of both the Old and the New World, particularly abundant in South Africa and Australia, a few extending beyond the arctic circle.

Several of the species are valued as forage plants. Cultivated oats, *Avena sativa*, is the best-known example of this tribe.

Holcus Linn., in part.*

Aira Linn.*

Weingaertneria Bernh.*
(*Corynephorus* Beauv.)

Deschampsia Beauv.*

Trisetum Pers.*

Avena Linn.*

Arrhenatherum Beauv.*

Danthonia DC.*

TRIBE X.—*Chlorideæ*.

Spikelets one- to several-flowered in one-sided spikes or racemes; these racemes digitate or fasciculate, rarely solitary; flowering glumes usually keeled, entire and unawned, or toothed, and with one or three straight awns.

A small tribe of twenty-seven genera and one hundred and fifty-five species, characterized chiefly by the inflorescence, which is nearly that of *Paspalum*. The awns when present are not dorsal nor twisted, as in *Agrostideæ* and *Aveneæ*. Chiefly natives of tropical and subtropical countries; a few are widely distributed as weeds throughout the warmer parts of the world. A number are good turf-forming grasses, and are valued for grazing purposes. One of these is the celebrated buffalo-grass of the Western plains, which is remarkable for having the staminate and pistillate spikelets separate and in unlike inflorescences, either upon the same plant (monœcious) or upon different plants (diœcious).

Capriola Adans.*

(*Cynodon* Pers.)

Spartina Schreb.*

Campulosus Desv.*

(*Ctenium* Panzer).

Chloris Sw.*

Trichloris Fourn.*

Gymnopogon Beauv.*

Schedonnardus Steud.*

Bouteloua Lag.*

Beckmannia Host.*

Eleusine Gaertn.*

Dactyloctenium Willd.*

Leptochloa Beauv.*

Bulbilis Raf.*

(*Buchloë* Engelm.)

TRIBE XI.—*Festuceæ*.

Spikelets two- to many-flowered, usually hermaphrodite, pedicellate in racemes or panicles, the latter sometimes dense and spike-like; flowering glumes usually longer than the empty ones, awnless or with one to several straight (rarely bent) awns which are either terminal or borne just below the apex.

This is the largest tribe in the order, numbering seventy-six genera and about seven hundred and twenty-five species. It contains the most important meadow grasses of the temperate regions as well as the more prevalent grasses of the higher mountains within the Tropics. The genus *Poa*, which includes Kentucky blue-grass, Texas blue-grass, etc., numbers one hundred species, and an equal number of species are included in the genus *Eragrostis*. The Fescues number eighty species, and the tribe takes its name from this genus—*Festuca*. Orchard grass, *Dactylis glomerata*, is a well-known example of this tribe.

Pappophorum Schreb.*	Melica Linn.*
Cottea Kunth.*	Korycarpus Zea.*
Cathestecum Presl.*	(<i>Diarrhena</i> Raf.)
Scleropogon Philippi.*	Pleuropogon R. Brown.*
Monanthochloë Engelm.*	Uniola Linn.*
Munroa Torrey.*	Distichlis Raf.*
Oreuttia Vasey.*	Briza Linn.*
Gynerium HBK.	Dactylis Linn.*
Arundo Linn.	Cynosurus Linn.*
Phragmites Trin.*	Lamarckia Moench.*
Blepharidachne Hack.	Poa Linn.*
(<i>Eremochloë</i> S. Wats.)	Colpodium Trin.
Triodia R. Br.*	Dupontia R. Br.
Sieglingia Bernh.	Scolochloa Link.
Redfieldia Vasey.*	Grapphephorum Desv.*
Dissanthelium Trin.*	Panicularia Fabr.*
Molinia Schrank.	(<i>Glyceria</i> R. Br.)
Eragrostis Host.*	Puccinellia Parl.*
Eatonia Raf.*	Festuca Linn.*
Koeleria Pers.*	Bromus Linn.
Catabrosa Beauv.*	

TRIBE XII.—*Hordeæ*.

Spikelets one- to many-flowered, usually hermaphrodite, sessile along the common rachis, forming a simple or compound spike;¹ glumes awned or awnless.

A small tribe of twenty genera and about one hundred and thirty species. It is an important division, however, for it includes rye, barley, and the many varieties of wheat. English and Italian Rye-grasses (*Lolium* species) are the chief meadow grasses of the tribe.

Nardus Linn.*

Secale Linn.

Lolium Linn.*

Triticum Linn.

Lepturus R. Br.

Hordeum Linn.*

Scribneria Hack.*

Elymus Linn.*

Agropyron Gaertn.*

Asperella Humb.*

TRIBE XIII.—*Bambusæ*.

Spikelets two- to many-flowered (rarely only one-flowered) in racemes or panicles; empty glumes at the base of the spikelet two to several; flowering glumes many-nerved, awnless, or very rarely short-awned; culms woody, at least near the base, and perennial; leaf blade usually with a short petiole articulated with the sheath from which it finally separates.

A comparatively small tribe of twenty-three genera and about one hundred and eighty-five species. The species are confined chiefly to the region within the Tropics. Many of them are of very great importance to the natives of the countries where they grow. Manufactured articles of bamboo, either of use or for ornament, are now a part of the commerce of the world. The bamboos are remarkable for their woody stems and often arborescent or tree-like habit of growth, some of the

¹ Strictly the spike is simple when the sessile spikelets are one-flowered, and compound when they are more than one-flowered.

species attaining the height of 25 to 30 m. In parts of India they form extensive forests. One species in this tribe has leaves 2 to 5 m. long by 10 to 25 cm. wide; another, a Cuban species, has leaves 5 to 8 cm. long and as fine as a horse hair. Fleshy and edible, apple-like fruits are borne by some of the species.

Arundinaria Michx.

F. L. S.

AMERICAN GRASSES—I.

(ILLUSTRATED.)

BY F. LAMSON-SCRIBNER.

METRIC MEASUREMENTS AND THEIR ENGLISH EQUIVALENTS.

The metric system adopted in this Bulletin is now quite generally employed in botanical and other scientific publications. For those unfamiliar with this system the following expression of equivalents may be useful:

1 millimètre (1 mm.)=one twenty-fifth of an inch—exactly 0.0394 inch.

1 centimètre (1 cm.)=nearly one-half of an inch; 10 cm.=about 4 inches.

1 décimètre (1 dm.)=about 4 inches, or 3 dm.=one foot.

1 mètre (1 m.)=about 3 feet 3 $\frac{3}{4}$ inches—exactly 39.37079 inches.

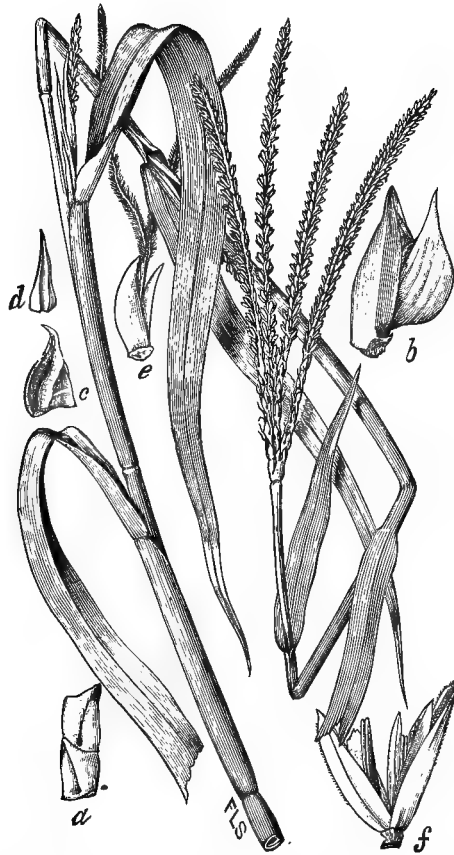


FIG. 1. *Tripsacum dactyloides* L. GAMA-GRASS.—A stout, coarse, branching perennial 9 to 24 dm. high, with long and rather broad leaves and a spicate inflorescence, the spikes being 2 to 4 on the main stem and usually solitary on the branches.—Low meadows, moist thickets, ditches, etc.; Rhode Island to Florida, Kansas, and Texas. [Mexico.] April–October.

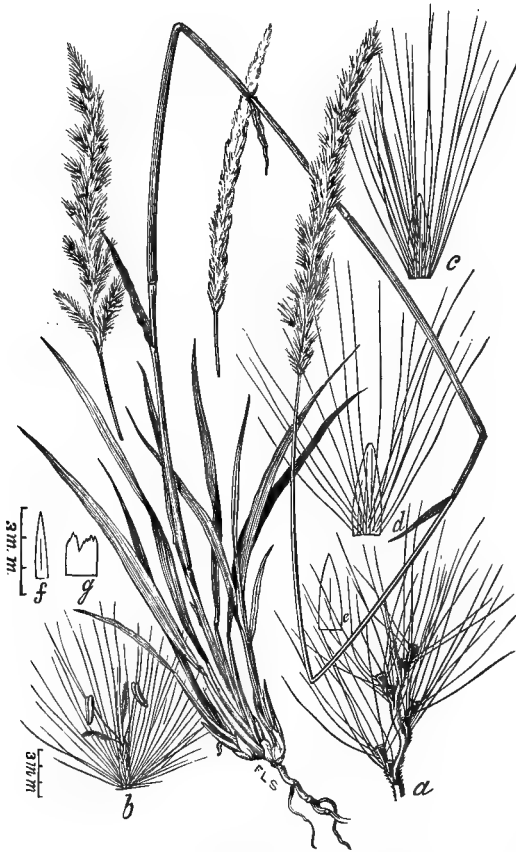


FIG. 2. *Imperata hookeri* Rupr. (*I. brevifolia* Vasey; *I. caudata* Scribn. not Trin.); Beal, Grasses N. Am., 2: 22.—A stout, glabrous perennial 5 to 12 dm. high, with strong, creeping rootstocks, flat leaves, and elongated white-hairy, densely flowered panicles.—Western Texas, Nevada, New Mexico, Arizona, Southern California and southward.

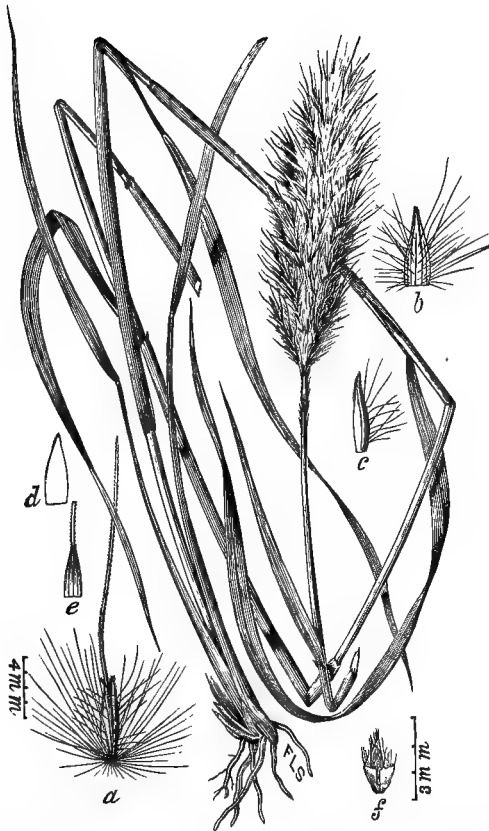


FIG. 3. *Erianthus compactus* Nash in Bull. Torr. Bot. Club, 22: 419; Britton and Brown, Ill. Fl., 1: 99. DENSELY FLOWERED PLUME-GRASS.—A stout, erect perennial 12 to 24 dm. high, with long, narrow leaves and densely flowered, oblong, brownish or reddish panicles 10 to 15 cm. long, the branches spreading in anthesis.—Meadows and swamps, mostly near the coast; New Jersey to Virginia and Tennessee. August–October.

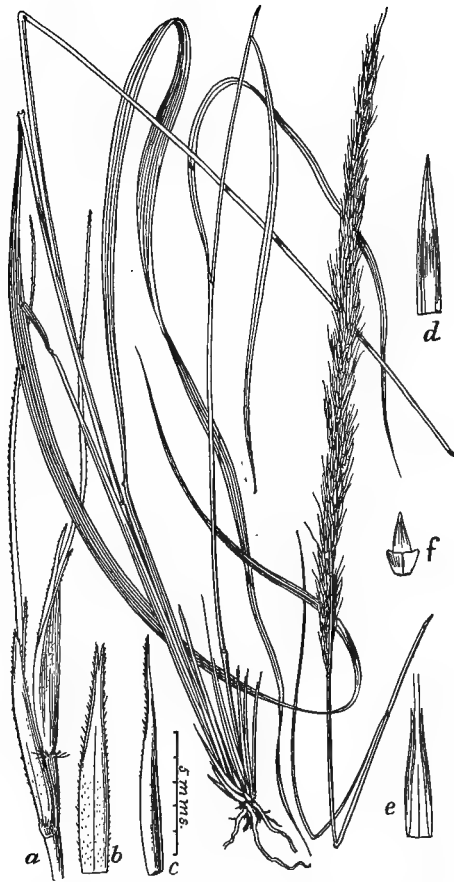


FIG. 4. *Erianthus strictus* Baldw.; Beal, Grasses N. Am., 2: 29.—A stout, erect perennial 12 to 24 dm. high, with long, narrow, flat leaves and strict, bearded (with awns), but not hairy, panicles, 20 to 40 cm. long.—River bottoms, Tennessee and Georgia to Mississippi and Texas. September, October.



FIG. 5. *Manisuris compressa* (L. f.) Kuntze (*Rottboellia compressa* L. f.; *Hemarthria fasciculata* Kunth). MAT-GRASS.—A creeping perennial, with ascending and usually much branched, flattened culms 10 to 14 dm. high, and numerous slender spikes.—River banks, southwestern Texas. [Tropical and subtropical regions of both hemispheres.] September.



FIG. 6. *Hackelochloa granularis* (Sw.) Kuntze (*Manisuris granularis* Sw.; *Cenchrus granularis* Linn.); Beal, Grasses N. Am., 2: 33. LIZARD-TAIL-GRASS.—A much-branched, leafy annual, 3 to 12 dm. high, with numerous slender spikes in irregular, leafy panicles.—A weed in all tropical countries, extending northward into the warmer parts of the Southern and Southwestern States.

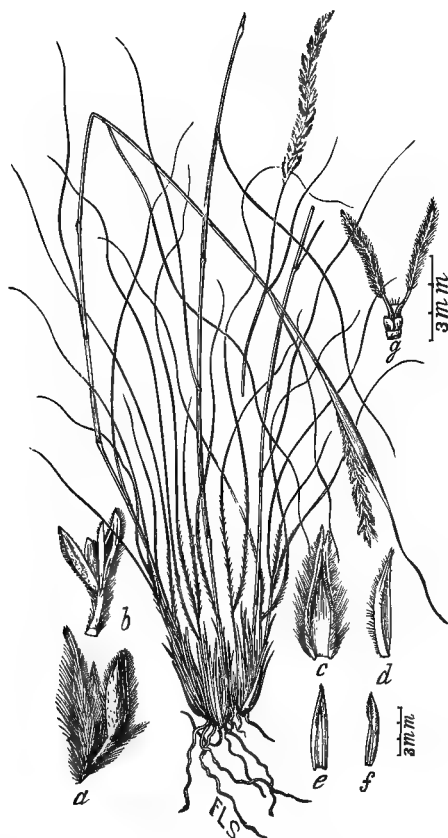


FIG. 7. *Elionurus barbiculmis* Hack.; Beal, Grasses N. Am., 2: 37.—A slender, erect perennial 4 to 7 dm. high, with very narrow, filiform, hairy leaves and silky-villous, solitary spikes terminal on the culm or its branches.—Rocky hills and canyons, western Texas to Arizona. [Northern Mexico.] June–September.

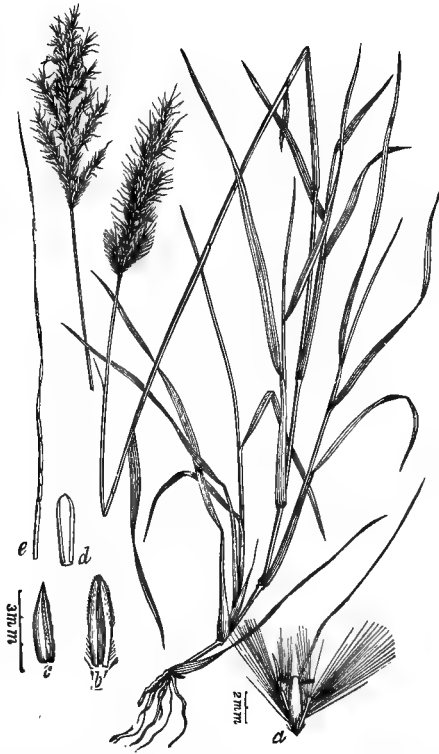


FIG. 8. *Andropogon saccharoides torreyanus* (Steud.) Hack; Britton and Brown, 1: 103 (*Andropogon torreyanus* Steud.). TORREY'S SILVER BEARD-GRASS.—A variable native perennial 3 to 9 dm. high, with rather long, usually glaucous, flat leaves, and narrow silvery-bearded panicles.—Dry prairies and mesas, Kansas to Texas, New Mexico, and Nevada. [Mexico.] July–October.



FIG. 9. *Andropogon glomeratus* (Walt.) B. S. P. (*Andropogon macrourus* Michx.). BROOK-GRASS.—A stout perennial 6 to 12 dm. high, with dense, more or less elongated panicles, the branches usually very much crowded.—Low grounds and marshes, southern New York to Florida, southern California and Nevada. [Mexico, Lower California, Cuba, and Jamaica.] September-January.



FIG. 10. *Andropogon virginicus* L. BROOM SEDGE.—A rigidly erect perennial 6 to 12 dm. high, with the culms flattened near the base, and narrow, elongated, and loosely branched panicles of silky-bearded racemes, for the most part partially inclosed within smooth, spathe-like bracts.—Old fields and borders of woods, usually in dry soil, Massachusetts to Florida and Texas. [Cuba.] August–October.



FIG. 11. *Andropogon argyræus* Schultes. SILVER-BEARD or SILVERY BEARD-GRASS.—A rather slender native grass 6 to 9 dm. high, with narrow leaves and silky-bearded racemes, which are in pairs, terminal on the culm or its branches.—In dry, sandy soil in open woods and along thicket borders from Delaware to Missouri and southward to the Gulf. August-October.

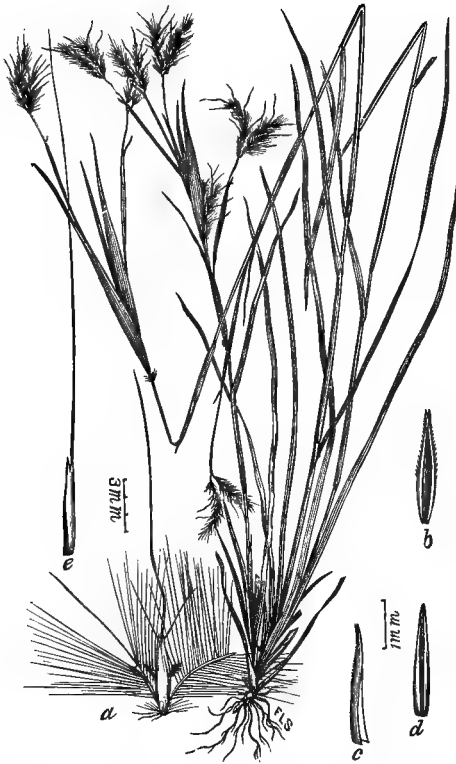


FIG. 12. *Andropogon eliottii* Chapm. ELLIOTT'S BROOM SEDGE.—A slender, upright perennial 6 to 9 dm. high, the plumose racemes in pairs or ternate and subtended by conspicuously inflated upper leaf sheaths.—Dry upland woods or low pine barrens, Delaware and Pennsylvania to central Florida and Texas. July–October.



FIG. 13. *Andropogon scoparius* Michx. LITTLE BLUE-STEM.—A rather slender perennial 3 to 9 dm. high, the solitary racemes terminating the culms and branches.—Dry fields and borders of woods, New Brunswick westward to the Saskatchewan, southward to Florida, Texas, and southern California. [Mexico.] July-October.



FIG. 14. *Andropogon provincialis* Lam. (*A. furcatus* Muhl.)
 BIG BLUE-STEM.—A stout perennial 6 to 16 dm. high, with long
 leaves, and rather thick spikes 3 to 10 cm. long.—From the Rocky
 Mountains eastward to the Atlantic and southward to the Gulf
 of Mexico. August–October. Especially abundant and valued
 for hay in the prairie regions.



FIG. 15. *Andropogon nutans avenaceus* (Michx.) Hack.
 INDIAN GRASS.—A stout perennial 12 to 18 dm. high, with long
 leaf blades, and long, rather dense, usually somewhat nodding
 brownish panicles.—Dry fields, glades, and borders of woods,
 Ontario to South Dakota and Manitoba, south to Florida, Texas,
 and Arizona. [Mexico, Central and South America.] July–October.

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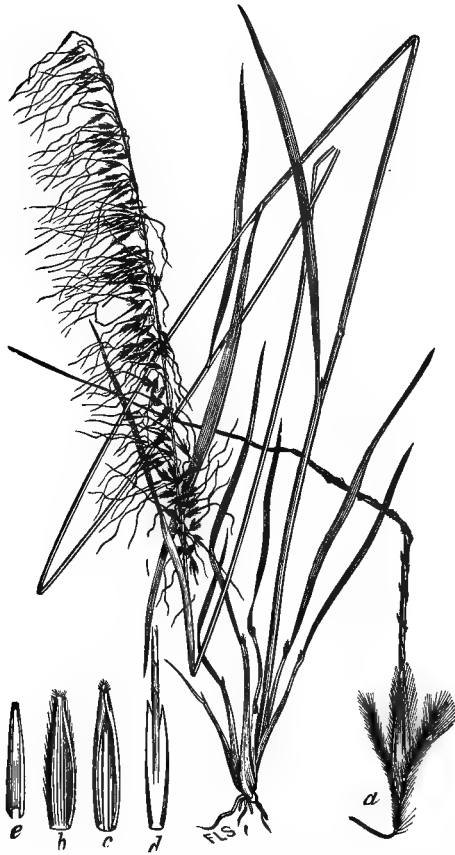


FIG. 16. *Andropogon unilateralis* Hack.; Beal, Grasses N. Am., 2:60. (*Andropogon secundus* Ell. not Willd.) BANNER SORGHUM.—A rather stout perennial, 6 to 12 dm. high, with narrow, one-sided, many-flowered panicles 18 to 25 cm. long, and long-awned spikelets.—Low pine lands, South Carolina, Florida. June-October.



FIG. 17. *Andropogon pauciflorus* (Chapm.) Hack.; Beal, Grasses N. Am., 2: 61. (*Sorghum pauciflorum* Chapm.). FEW-FLOWERED SORGHUM.—A rather stout, branching, leafy annual, 6 to 12 dm. high, with few-flowered panicles and long-awned spikelets.—Dry fields, Florida. [Cuba.] October.



FIG. 18. *Hilaria cenchroides* HBK.; Beal, Grasses N. Am., 2: 68. CURLY MESQUITE.—A slender, creeping perennial, with upright leafy branches 1 to 3 dm. high.—Dry prairies, mesas, and foothills, Texas to Arizona. [Mexico.] April–October. One of the most valuable of the native grasses for grazing.



FIG. 19. *Hilaria mutica* (Buckl.) Benth.; Beal, Grasses N. Am., 2: 69. BLACK GRAMA.—A smooth, branching perennial 4 to 6 dm. high, with densely flowered, usually straw-colored spikes about 5 cm. long.—Dry mesas, Texas to southern California. May–September. Valued for forage, especially for grazing.



FIG. 20. *Hilaria jamesii* (Torr.) Benth.; Beal, Grasses N. Am., 2: 70. BLACK BUNCH-GRASS.—A rather coarse, branching perennial 3 to 5 dm. high, with erect, often purplish spikes 5 to 8 cm. long.—Mesas and table-lands of southern Colorado and Utah to New Mexico and southern California. March-July. A valuable hay or pasture grass.



FIG. 21. *Hilaria rigida* (Thurb.) Vasey; Beal, Grasses N. Am., 2: 68. (*Pleuraphis rigida* Thurb.) GALLET. —A coarse, much-branched, and woody perennial 6 dm. high, growing in great clumps, somewhat resembling dwarf bamboos in habit —Deserts, southern Utah to Arizona and southern California. [Lower California.] May-July.



FIG. 22. *Reimaria oligostachya* Munro in Benth. Journ. Linn. Soc.; Beal, Grasses N. Am., 2: 80. CREEPING REIMARIA.—An extensively creeping perennial, with flat leaves and upright flowering branches 2 to 4 dm. high, bearing two to four spikes 4 to 7 cm. long.—Ditches and brackish river shores, often in water, eastern Florida. [Cuba.] April-September.

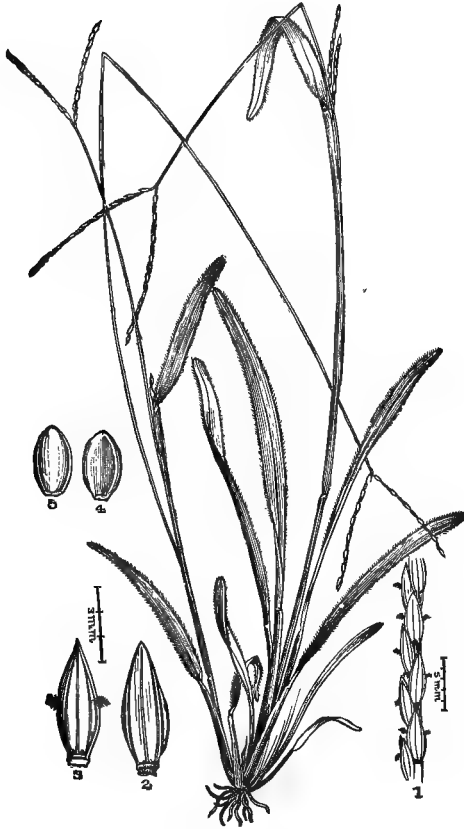


FIG. 23. *Paspalum paspaloides* (Michx.) Scribn. (*P. elliotii* S. Wats.; *P. digitaria* Poir.). ELLIOTT'S PASPALUM.—A soft perennial grass 5 to 8 dm. high, geniculate and more or less creeping at the base, with rather broad, flat leaves and slender spikes, which are usually in pairs.—Borders of ponds and ditches and in low pine barrens near the coast, Maryland to Texas. April–August.



FIG. 24. *Paspalum compressum* (Sw.) Nees. (*P. platycaule* Poir.). LOUISIANA or CARPET-GRASS.—A slender, erect, or more frequently prostrate and extensively creeping perennial, rooting at the nodes and sending up numerous leafy or flower-bearing branches 1.5 to 6 dm. high, with 2 to 6 subdigitate slender spikes and small, acutish spikelets.—Low ground and moist pastures, abundant near the coast from Virginia to Texas. [Mexico, Central and South America, and West Indies.] April–October. A valuable pasture grass.

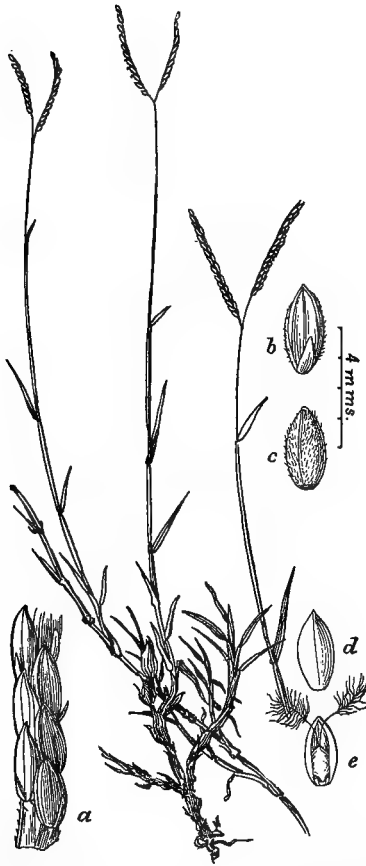


FIG. 25. *Paspalum distichum* L. KNOT-GRASS.—A low, creeping, somewhat succulent perennial, with flat leaves and two spikes at the apex of the upright flower-bearing branches, which are 1 to 3 dm. high. Habit of growth resembling Bermuda-grass.—Ditches and muddy or sandy shores, Virginia and Missouri to Florida, Texas, and southern California; northward on the Pacific Coast to Oregon. [Widely distributed in tropical and subtropical regions.] April-October.



FIG. 26. *Paspalum setaceum* Michx. SLENDER PASPALUM.—A slender, erect, or ascending native perennial, usually about 6 dm. high, with flat, often hairy leaves, and slender, small-flowered spikes.—Dry, sandy fields and pine barrens, Massachusetts to northeastern Nebraska, Texas and Florida. April–October.

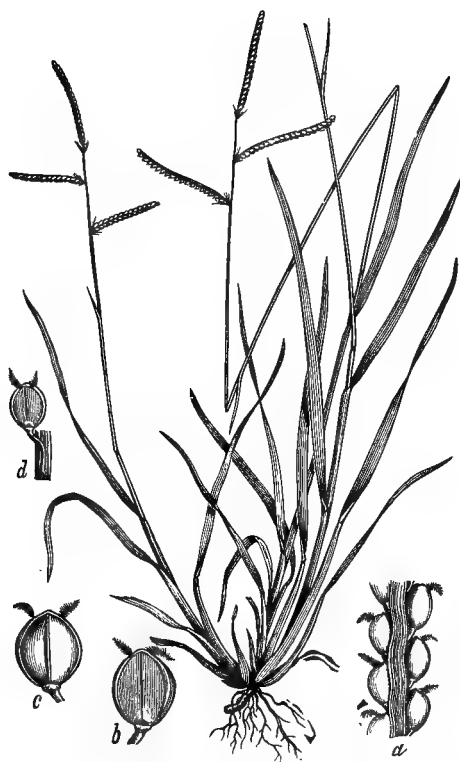


FIG. 27. *Paspalum laeve* Michx. SMOOTH PASPALUM.—Perennial, with ascending culms, often geniculate at base, 3 to 9 dm. high, with smooth or pilose leaf sheaths and blades, and 3 to 7 spreading spikes 5 to 10 cm. long. Low, often wet, ground, Rhode Island to Florida, eastern Texas and Missouri. June–October.

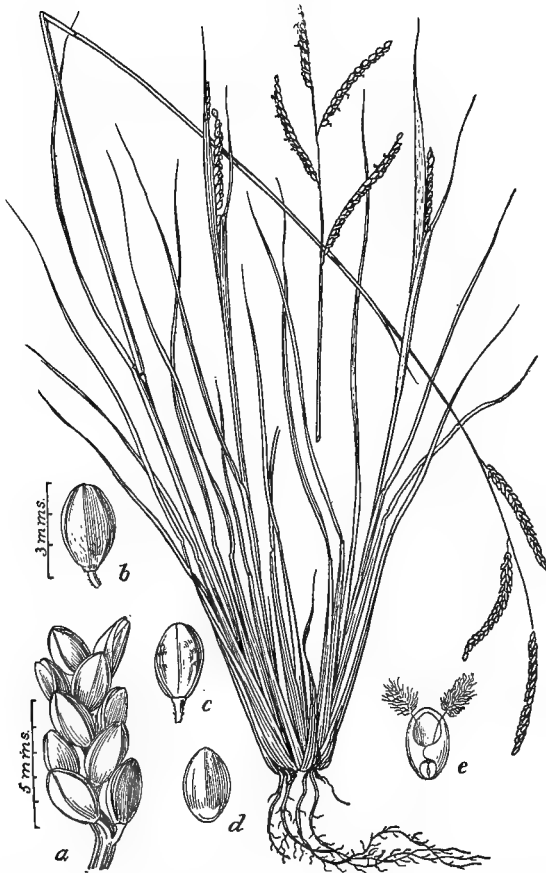


FIG. 28. *Paspalum plicatulum* Michx.; Beal, Grasses N. Am., 2: 90. WRINKLE-FLOWERED PASPALUM.—An erect or ascending perennial 3 to 6 dm. high, with smooth or flat leaves and 5 to 7 rather densely flowered racemes. The second glume is usually plicate or wrinkled.—Dry fields and open pine woods, Georgia and Florida to Texas. [Mexico, Central and South America, and West Indies.] April–October.



FIG. 29. *Paspalum difforme* Le Conte; Vasey Proc. Acad. Nat. Sci. Phila. 1886, 286.—A stout perennial, from creeping rootstocks. Allied to *P. floridanum*, but less robust, with shorter leaves and spikes.—Dry pine barrens near the coast, North Carolina to Florida and westward to Texas. June–October.

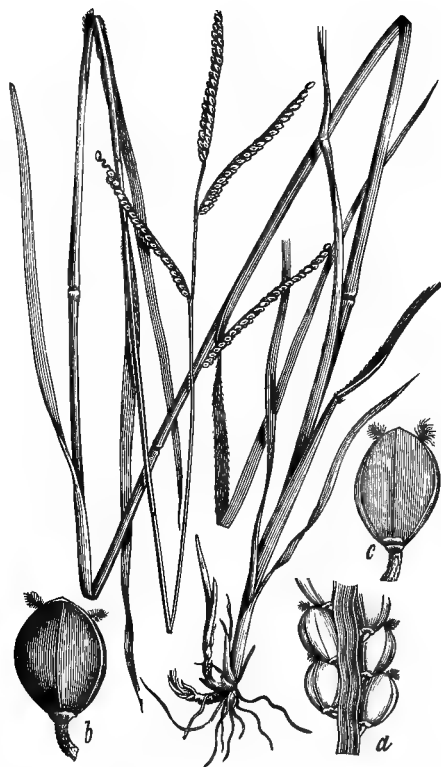


FIG. 30. *Paspalum floridanum* Michx. FLORIDA PASPALUM.—A stout, erect grass 9 to 12 dm. high, often glaucous, with long leaves, smooth or villous sheaths and blades, and large spikelets. Dry or moist low ground, Delaware to Florida, Texas, Kentucky, and Indian Territory. June–October.

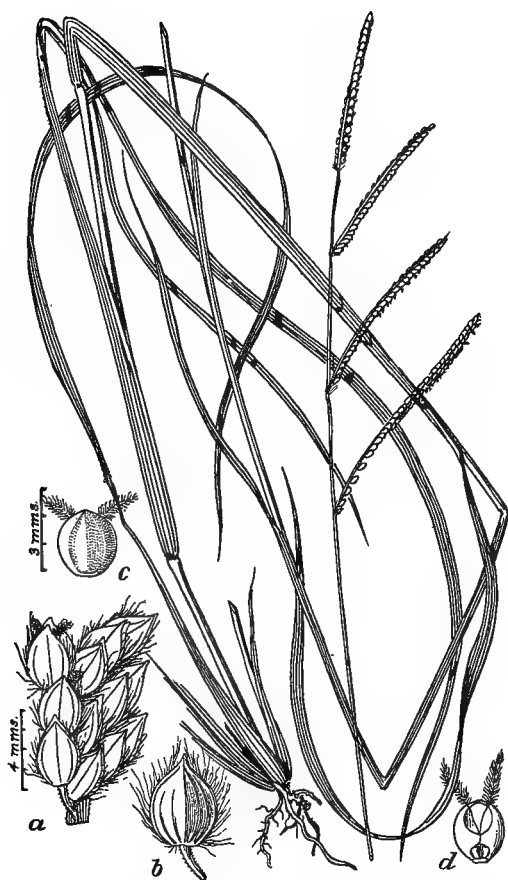


FIG. 31. *Paspalum dilatatum* Poir. (*P. ovatum* Nees). LARGE WATER-GRASS.—A somewhat coarse, leafy perennial, growing in clumps 6 to 15 dm. high, bearing 2 to 10 more or less spreading racemes of hairy spikelets.—In meadows, waste ground, and along ditches, southeastern Virginia to Florida, west to Texas; apparently naturalized. [South America.] July–October.

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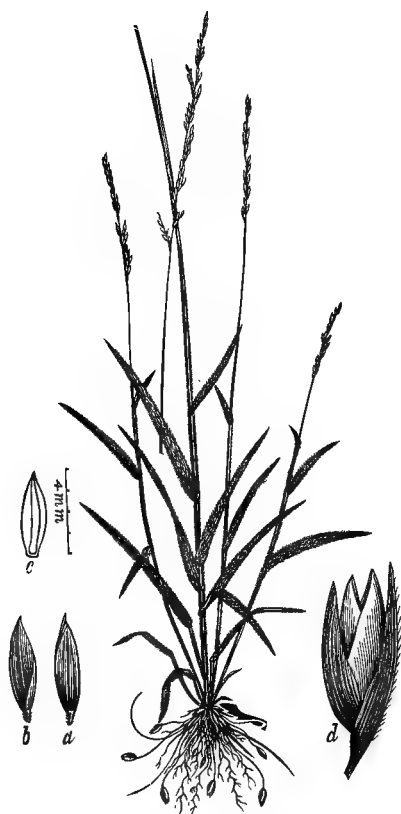


FIG. 32. *Amphicarpon purshii* Kunth. PURSH'S AMPHICARPON.—An erect, tufted perennial 3 to 12 dm. high, with hispid sheaths and leaves and contracted panicles. Fertile spikelets solitary and subterranean.—Pine barrens and cranberry bogs near the coast, New Jersey. August, September.

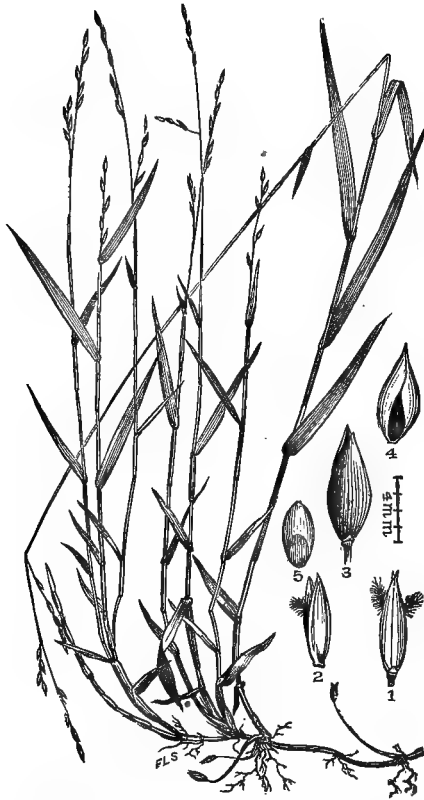


FIG. 33. *Amphicarpum floridanum* Chapm.; Beal, Grasses N. Am., 2: 100. FLORIDA AMPHICARPON.—A pale-green, smooth perennial 3 to 9 dm. high, from creeping rootstocks, with flat leaves and narrow panicles 10 to 20 cm. long. Fertile spikelets on subterranean branches.—Moist pine barrens and sandy shores, Florida (throughout the State). July-September.



FIG. 34. *Eriochloa mollis* (Michx.) Kunth. (*Panicum molle* Michx.), Beal, Grasses N. Am., 2: 102. SOFT WOOL-GRASS.—A perennial 10 to 20 dm. high, with long, flat leaves and open panicles of numerous, more or less spreading racemes 3 to 6 cm. long.—Brackish marshes and shores, South Carolina to Florida. April-September.



FIG. 35. *Eriochloa punctata* (L.) W. Hamilt. EVERLASTING-GRASS.—A rapid-growing, smooth and somewhat succulent perennial, with more or less branching culms 6 to 12 dm. high, flat leaves and narrow panicles 5 to 10 cm. long.—Low, rich land, moist soil, prairies, etc., Kansas to Texas and Arizona. [Tropical America, Asia, and Australia.] June-September.



FIG. 36. *Eriochloa lemmoni* Vasey & Scribn.; Beal, Grasses N. Am., 2: 101. LEMMON'S WOOL-GRASS.—A softly pubescent perennial 3 to 6 dm. high, with rather broad leaves and a short panicle composed of about 6 spreading spikes 2 to 3 cm. long.—Arizona. [Northern Mexico.] August–November.

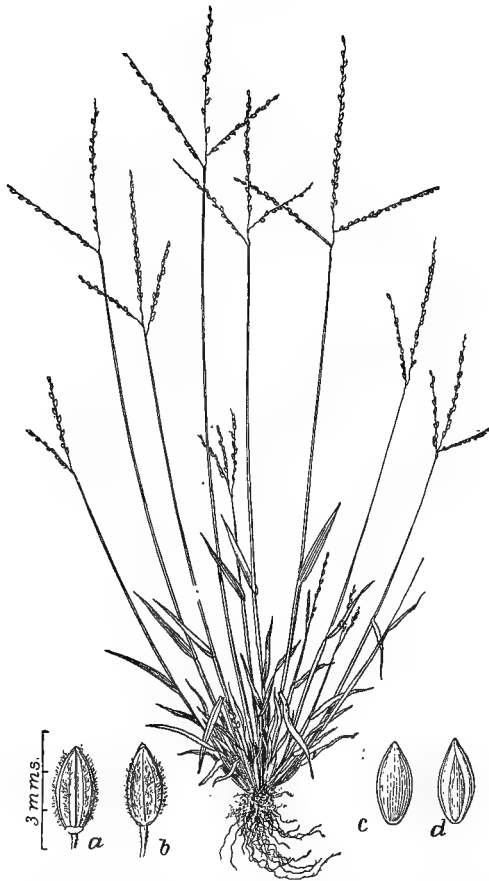


FIG. 37. **Panicum lineare** Krock (*Panicum glabrum* Gaud.; *Syntherisma linearis* Nash). SMOOTH CRAB-GRASS.—A slender, glabrous annual 1.5 to 3.5 dm. high, with culms which are much branched below, flat leaves, and 2 to 6 slender diverging spikes.—Naturalized in waste and cultivated land; Nova Scotia to Ontario and South Dakota, south to Florida and Texas. [Europe.] August–October.



FIG. 38. *Panicum serotinum* (Walt.) Trin. (*Syntherisma serotina* Walt.; *Digitaria serotina* Mx.). LITTLE CRAB-GRASS.—An extensively creeping annual or biennial, with flat, hairy leaves, and slender spikes digitate at the apex of the ascending culms, which are 1 to 3 dm. high.—Low, sandy ground, roadsides, pastures, and cultivated fields near the coast, Delaware to Mississippi; on ballast at Philadelphia. June–August.



FIG. 39. *Panicum gracillimum* Scribn.; Bull. Torr. Bot. Club, 23: 146. SLENDER PANICUM.—A slender perennial 3 to 9 dm. high, with very narrow, elongated leaves and small, glabrous spikelets, racemose along the main axis and its branches, which are approximate near the apex of the culm. Outer glumes glabrous.—High pine lands, Lake County, Florida. (1192, Nash.) July.



FIG. 40. *Panicum leucomomum* Scribn. (*P. phaeothrix* in ed. 1). SILVERY PANIC-GRASS.—A slender perennial about 9 dm. high, with long, narrow leaves and very slender, rather loosely flowered racemes 10 to 20 cm. long, approximate near the apex of the clum. Outer glumes densely clothed with soft white hairs.—High pine lands, Florida. (Nash, 1155.) July.

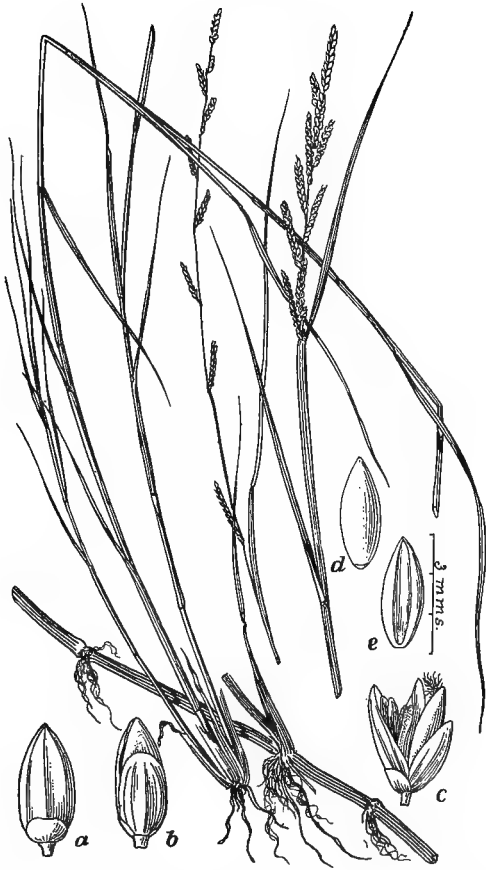


FIG. 41. *Panicum paspaloides* Pers.; Beal, Grasses N. Am., 2: 114. SOUTHERN WATER-GRASS.—A rather stout, smooth, and more or less branching perennial 6 to 9 dm. high, often creeping at the base, with long, flat leaves, and ten to twenty alternate, one-sided spikes 2 to 3 cm. long.—About ponds and in standing water, southern Florida; Texas. [In tropical countries of both hemispheres.] May–July.



FIG. 42. *Panicum lanatum* Rottb. (*P. leucophæum* HBK.); Beal, Grasses N. Am., 2: 111. COTTON-GRASS.—A rather stout, more or less branching leafy perennial 6 to 12 dm. high, with narrow, soft-hairy panicles.—Cultivated ground, river banks, and coral soil on keys, central and southern Florida; on ballast at Mobile, Ala. [Widely distributed in tropical America; Australia; Africa.] May–October.



FIG. 43. *Panicum grossarium* L.; Beal, Grasses N. Am., 2: 116. JAMAICA CRAB-GRASS.—Apparently an annual, with much-branched, ascending culms 3 to 6 dm. long, broad, lanceolate leaves and spreading panicles of a few simple racemes of glabrous spikelets.—Ballast ground, Philadelphia. Adventive. [West Indies.] September. Cultivated in grass garden, and apparently valuable.



FIG. 44. *Panicum texanum* Buckl.; Beal, Grasses N. Am., 2: 117. TEXAS MILLET.—A branching, leafy annual 6 to 12 dm. high, with flat leaves and narrow panicles 1.5 to 2 dm. long.—Texas. September.



FIG. 45. *Panicum obtusum* HBK.; Beal, Grasses N. Am., 2: 115. VINE MESQUITE-GRASS.—Stoloniferous perennial, the runners often 24 to 30 dm. long; the upright flowering branches 3 to 6 dm. high. Panicle of three to five erect racemes, bearing rather large obtuse spikelets.—Irrigated lands, low valleys, chiefly in the shade of trees and shrubs, Kansas and Colorado to Texas, New Mexico, Arizona, and southward. June–September.

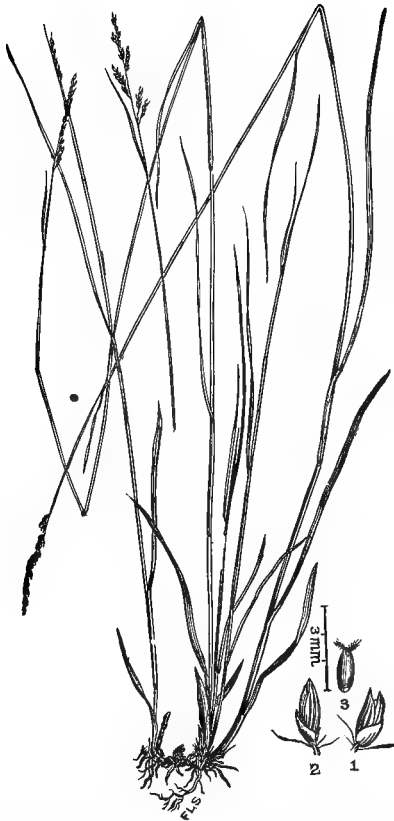


FIG. 46. **Panicum stenodes** Griseb. (*P. anceps strictum* Chapm.); Beal, Grasses N. Am., 2: 126. SMALL-JOINTED PANIC-GRASS.—A slender, erect, glabrous perennial, with wiry stems 5 to 8 dm. high, rigid, involute leaves, and narrow, simple panicles 4 to 8 cm. long.—Moist, sandy pine barrens near the coast, Florida to Texas. [Cuba and San Domingo.] July–October.

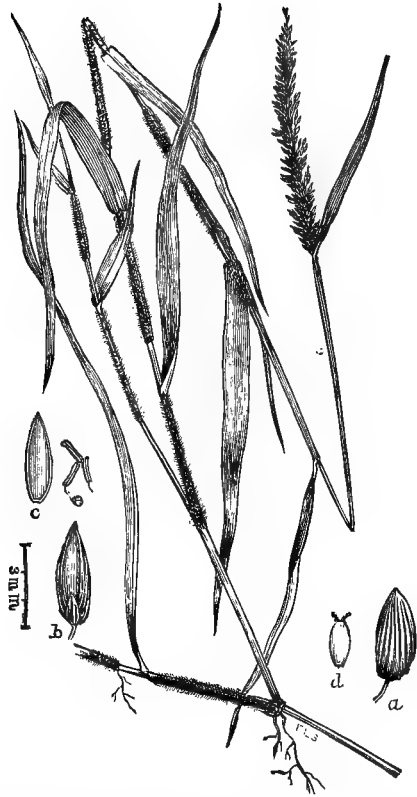


FIG. 47. *Panicum gibbum* Ell. GIBBOUS PANIC-GRASS.—A stoloniferous, branching perennial 3 to 9 dm. high, with narrowly lanceolate, flat leaves, and densely flowered spike-like panicles 10 to 15 cm. long.—Low, wet grounds, Virginia to Florida, Tennessee, Louisiana, and Indian Territory. [Cuba.] June–October.

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FIG. 48. **Panicum melicarium** Michx. (*P. hians* Ell.); Beal, Grasses N. Am., 2 : 127.—A smooth, slender, usually erect perennial 2 to 5 dm. high, with narrow, flat leaves and simple, open panicles 6 to 15 cm. long.—Moist pine barrens and marshes, North Carolina to Florida, Missouri, Indian Territory, and Texas. March–October.

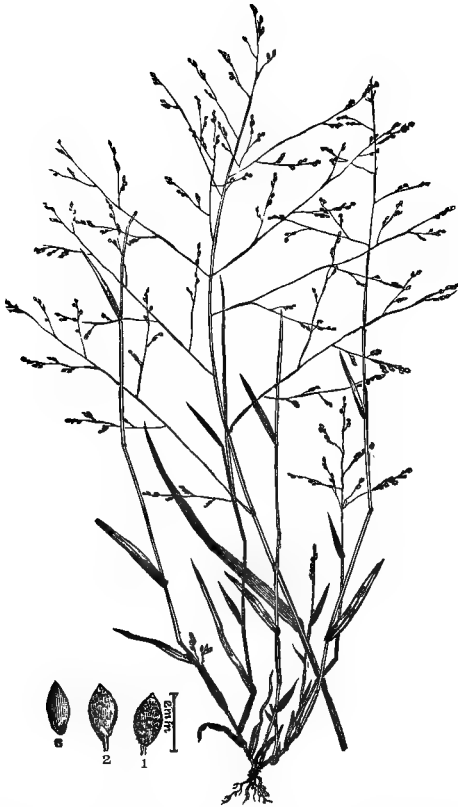


FIG. 49. *Panicum verrucosum* Muhl. WARTY PANIC-GRASS.—A slender, branching perennial, with flat leaves and few-flowered spreading panicles 7.5 to 20 cm. long.—Low, rich woodlands, mostly near the coast, New England to Florida, west to Tennessee and Louisiana. May–October.

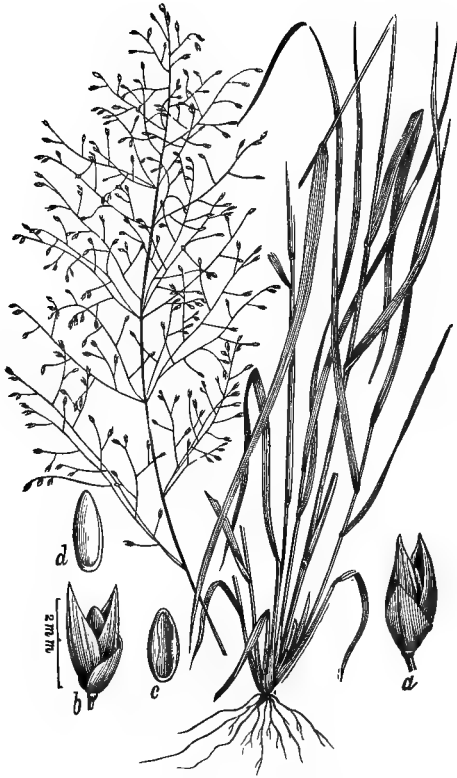


FIG. 50. *Panicum filipes* Scribn. in Heller, Contrib. Herb. Franklin & Marshall Coll., 1 : 13 (1895).—A slender, more or less branching and leafy, glaucous annual (?) 3 to 7 dm. high, with rather long, flat leaves and diffuse capillary panicles 15 to 30 cm. long.—Dry grounds, western Texas and (?) Mexico. May–July.



FIG. 51. *Panicum proliferum* Lam. SPROUTING CRAB-GRASS.—A smooth and usually much-branched, native annual, with rather coarse, spreading, or ascending stems 6 to 18 dm. long, flat leaves and diffuse terminal and lateral panicles.—Low ground, ditches, etc., Maine to Illinois and Nebraska, south to Florida and Texas. [Cuba]. March-October.

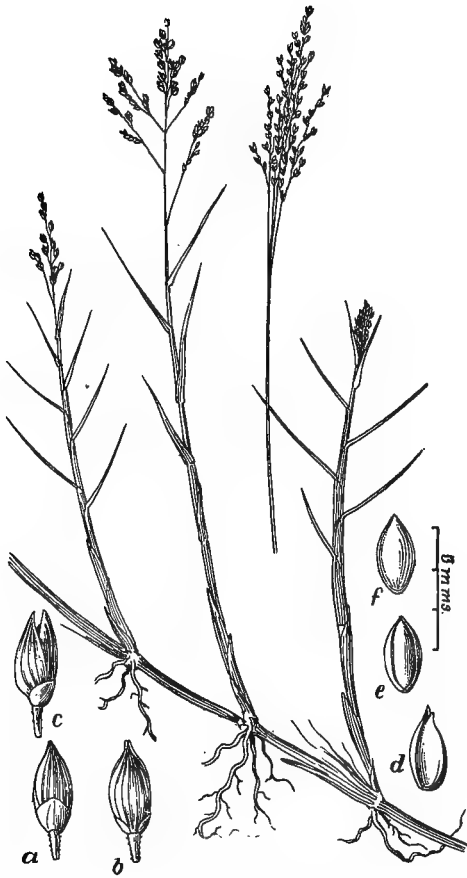


FIG. 52. *Panicum repens* L.; Beal, Grasses N. Am., 2: 127.
 CREEPING PANIC.—An extensively creeping, maritime grass, with
 rather stiff leaves and rigid, upright, flowering stems or branches
 2 to 5 dm. high.—Sea beaches, southern Alabama to Louisiana.
 [Tropical and subtropical coasts of both hemispheres.] A good
 sand-binder.



FIG. 53. *Panicum anceps* Michx. FLAT-STEMMED PANIC.—A rather stout perennial, with flattened stems 6 to 12 dm. high, long leaves, smooth or pilose sheaths, spreading panicles and pointed spikelets.—Low woods and thickets, marshes and banks of streams, Pennsylvania to Illinois, Missouri, Indian Territory, Texas, and Florida. July-October.



FIG. 54. *Panicum virgatum* L. SWITCH-GRASS.—A stout, erect perennial 9 to 15 dm high, usually forming large tufts, with strong, creeping rootstocks, long, flat leaves, and ample, spreading panicles.—Sandy soil, usually along streams and about ponds and lakes, Maine and Ontario to North Dakota, Colorado, Arizona, Texas, and Florida. [Mexico.] July–October.



FIG. 55. *Panicum amarum* Ell. BITTER PANIC-GRASS.—A stout, coarse perennial 3 to 12 dm. high, from strong, creeping rootstocks, with rather long (30 to 40 cm.), rigid leaves and many-flowered, open panicles 10 to 30 cm. long.—Sandy beaches, coast of southern New England to southern Florida. July–November. A good sand binder.



FIG. 56. *Panicum bulbosum* HBK.; Beal, Grasses N. Am., 2: 131. ALKALI SACCATONE.—A stout, glabrous perennial 9 to 12 dm. high, from a bulbous base, with flat leaves and usually ample panicles 20 to 40 cm. long.—In canyons, Texas to Arizona. [Mexico.] June–September. A valuable hay grass for alkaline soils.



FIG. 57. *Panicum sphærocarpon* Ell.; Britton and Brown, Ill. Fl., 1: 116. ROUND-FLOWERED PANIC.—A tufted, erect, or ascending perennial 25 to 60 cm. high, with rather broad, firm, and nearly erect leaf blades, diffuse many-flowered panicles and small, rounded spikelets.—Dry or moist woods and fields, Maine to southern Ontario, Wisconsin, Indian Territory, Texas, and Florida. [Mexico and Guatemala.] May–October.



FIG. 58. *Panicum boreale* Nash; Britton and Brown, Ill. Fl., 1: 119. NORTHERN PANIC-GRASS.—An erect, finally branching perennial 3 to 6 dm. high, with flat leaves and open, spreading panicles 4 to 8 cm. long.—Damp soil, Newfoundland and Ontario to Maine, New York, and Minnesota. June–August.



FIG. 59. *Panicum barbulatum* Michx. BEARDED-JOINT.— Culms 3 to 9 dm. high, finally much-branched, slender, smooth, except the nodes, which are conspicuously barbed with reflexed, white hairs, panicle ovate-pyramidal, spikelets numerous, small.— Bogs, wet meadows, and low woodlands, southern New York to Illinois, Florida, and New Mexico.



FIG. 60. *Panicum columbianum* Scribn. sp. nov. AMERICAN PANIC-GRASS.—A slender, erect, much-branched, glabrous perennial, with short (usually 3 to 4 cm. long), lanceolate, ascending, acute leaves, and small-flowered, diffuse, oblong or subpyramidal panicles. Spike-lets about 2 mm. long. Branches finally erect, numerous, flower-bearing.—Dry, sandy fields, meadows, and open woodlands, New England southward to the Carolinas, and westward to Tennessee and Alabama, mostly near the coast; also in California. June–August.



FIG. 61. *Panicum nashianum* Scribn. sp. nov. (allied to *P. demissum* Trin.). NASH'S PANIC-GRASS.—A slender and finally much-branched, leafy perennial 1 to 3.5 dm. high, with flat and rather short leaves, which are ciliate on the margins toward the base, and open pyramidal panicles, the flexuose branches widely spreading or reflexed. (4,029 Curtiss (1893), and 466 Nash (1894).)—Low pine barrens, often in moist ground, near the coast, Virginia to Mississippi. [Brazil.] March–October.



FIG. 62. *Panicum longipedunculatum* Scribn.; Bull. Tenn. Agr. Exp. Station, VII, 1 : 53. LONG-STALKED PANIC.—A slender, caespitose perennial 1.5 to 3 dm. high, with short, chiefly radical, pilose leaves and diffuse, small-flowered, long-exserted, hairy panicles.—Dry or moist pine barrens and damp woods, apparently rare, eastern Tennessee to eastern North Carolina and Florida. May–August.



FIG. 63. *Panicum colonum* L. JUNGLE RICE.—An erect or ascending, more or less branching annual 3 to 6 dm. high, with flat leaves and five to ten, densely flowered, one-sided spikes, 1 to 3 cm. long, racemose along the main axis.—Ditches and low ground, Southeastern Virginia and Tennessee to Florida, Texas, and southern California. [Widely distributed in tropical and subtropical regions of the Old World.] June–October.

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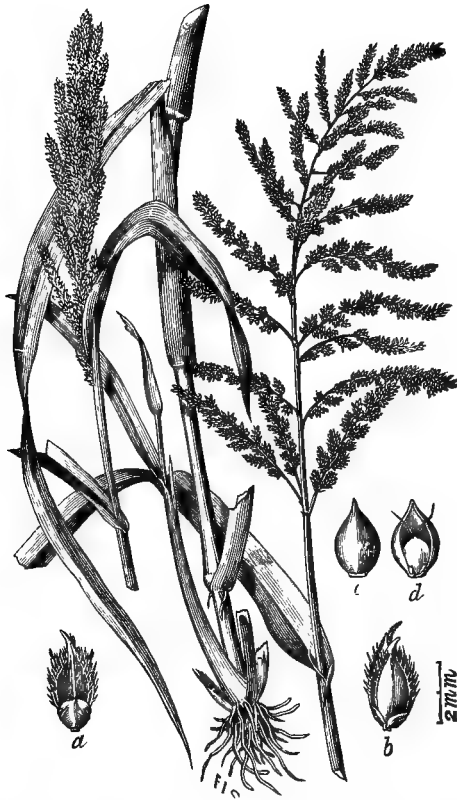


FIG. 64. *Panicum crus-galli* L. BARNYARD-GRASS.—A coarse, ascending or erect, leafy annual 3 to 15 dm. high, with dense panicles and with the third glume awnless to long-awned.—Almost everywhere in the United States in barnyards, waste ground, and river banks. Throughout the warmer regions of both hemispheres. Flowers all summer.



FIG. 65. *Chaetochloa viridis* (L.) Scribn. (*Panicum viride* L., *Setaria viridis* Beauv.). GREEN FOXTAIL.—A branching, leafy annual 3 to 6 dm. high, with bristly, densely many-flowered, spike-like panicles 5 to 10 cm. long. Bristles usually green and spikelets smaller than in Yellow Foxtail (*Chaetochloa glauca*).—A weed in cultivated and waste grounds; naturalized from Europe. June–October.

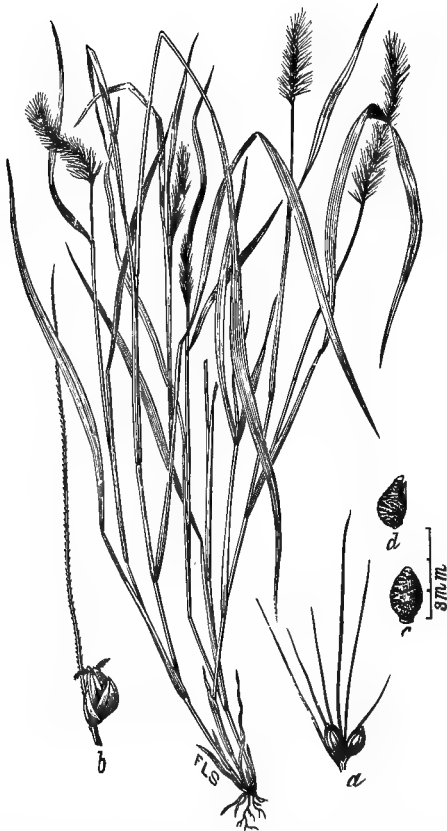


FIG. 66. *Chætochloa corrugata* (Ell.) Scribn. (*Panicum corrugatum* Ell.; *Setaria corrugata* Schult.). ROUGH FOXTAIL.—A rather slender annual 3 to 9 dm. high, usually much branched below, with flat leaves and bristly, spike-like panicles 3 to 10 cm. long.—Usually in cultivated land, Georgia and Florida. May–October.



FIG. 67. *Chaetochloa composita* Scribn. (*Setaria composita* HBK.?). BRANCHING FOXTAIL.—A stout perennial 6 to 12 dm. high, with broad, flat leaves, and branching, bristly panicles 10 to 25 cm. long. Spikelets 3 mm. long; second glume one-third shorter than the fourth. (No. 3617, A. H. Curtiss.)—Shell islands and keys, sometimes in old pineapple fields, southern Florida. [West Indies.] July–October.



FIG. 68. *Chaetochloa italica* (L.) Scribn. (*Setaria italica* Beauv.). ITALIAN MILLET or HUNGARIAN-GRASS.—A stout and rapidly growing leafy annual 10 to 24 dm. high, with large compound, nodding, bristly, and nearly cylindrical panicles 20 to 40 cm. long —In cultivated and waste land, escaped from cultivation or adventive here and there throughout the country. [Europe, Asia.] July, August.



FIG. 69. *Cenchrus tribuloides* L. SAND BUR.—An annual, with spreading or ascending, much-branched, compressed culms usually about 3 dm. high, and terminal racemes, of 6 to 20 bur-like involucres.—Sandy fields, waste ground, river banks, and sea beaches, Maine and Ontario to South Dakota and Colorado, south to Florida and southern California. [Mexico and South America.] June–October.



FIG. 70. *Cenchrus myosuroides* HBK. ; Beal, Grasses N. Am., 2:160. LONG-SPIKED BUR-GRASS.—A stout perennial 6 to 8 dm. high, more or less branching and geniculate below, with flat leaves and long, cylindrical spikes 12 to 20 cm. long.—Waste ground, introduced; southern Florida to Texas. [Mexico, South America.) August-January.



FIG. 71. *Pennisetum setosum* (Sw.) Rich.; Beal, Grasses N. Am., 2: 166.—A stout, branching perennial 9 to 12 dm. high, with flat leaves and dense, bristly, cylindrical spikes 10 to 15 cm. long.—Southern Florida. [Widely distributed in tropical countries.] September.

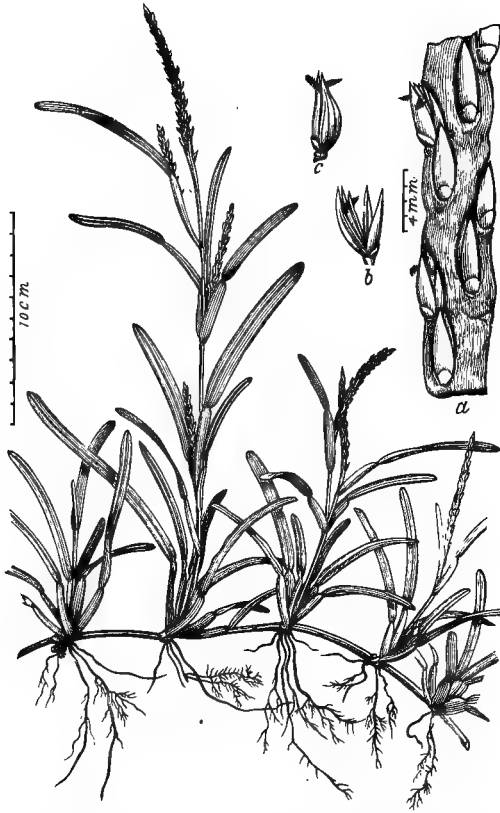


FIG. 72. *Stenotaphrum secundatum* (Walt.) Kuntze (*Ischaemum secundatum* Walt.; *Stenotaphrum americanum* Schrank.). MISSION-GRASS.—Extensively creeping perennial, with hard, flat stems, rather broad leaves, and upright, flowering stems 1.5 to 3 dm. high.—Muddy or moist sandy shores and marshes along the coast, South Carolina to Florida and Louisiana. [Widely distributed in tropical America and the Pacific islands.] April-October.



FIG. 73. *Luziola alabamensis* Chapm.; Beal, Grasses N. Am., 2: 172.—An aquatic, stoloniferous grass, the upright culms 0.5 to 1.5 dm. high, with long, narrow leaves and the staminate and pistillate spikelets in separate panicles.—In springy places and rivulets in the pine barrens, southern Alabama. [Cuba.] June-October.



FIG. 74. **Homalocenchrus lenticularis** (Michx.) Scribn. (*Leersia lenticularis* Michx.). CATCH-FLY-GRASS.—A rather stout, branching perennial 6 to 12 dm. high, with widely spreading, broad leaf blades, diffuse panicles, and large, ciliate spikelets.—Marshes and wet thickets, near the coast, Virginia to Texas, and in the Mississippi Valley from southern Illinois and Missouri to Louisiana. August, September.



FIG. 75. *Homalocenchrus hexandrus* (Sw.) Britton; Beal Grasses N. Am., 1: 179 (*Leersia hexandra* Sw.).—A rather slender, usually erect, branching grass 6 to 12 dm. high, with narrow, many-flowered panicles 10 to 15 cm. long.—In swamps and ditches near the coast, North Carolina to Florida and Texas. [In all tropical and many subtropical countries.] May–September.



FIG. 76. *Homalocenchrus oryzoides* (Sw.) Poll. (*Leersia oryzoides* Sw.); Britton and Brown, Ill. Fl., 1: 129. RICE CUT-GRASS.—A rather stout, rough, and much-branched grass 6 to 12 dm. high, with open, pale-green or straw-colored panicles 12 to 25 cm. long.—Along streams and ditches and in marshes, usually in the open, Nova Scotia and Ontario to Washington, Florida, and Texas. [Europe and Asia.] August–October.



FIG. 77. *Homalocenchrus virginicus* (Willd.) Britton, (*Leersia virginica* Willd.). WHITE-GRASS.—A slender, erect, or ascending, usually much-branched, perennial 6 to 12 dm. high, with narrow leaves and simple panicles 8 to 12 cm. long.—Moist thickets and low woods, usually along streams, Maine and Ontario to South Dakota, southward to Florida, and Texas. May–October.



FIG. 78. *Homalocenchrus monandrus* (Sw.) Britton (*Leersia monandra* Sw.); Beal, Grasses N. Am., 2: 179. SLENDER CUTGRASS.—A slender, sparingly branched grass with somewhat wiry culms 3 to 6 dm. high, and usually glaucous leaves.—Keys of south Florida (in coral soil) and in southern Texas. [Mexico, West Indies, and South America.] February–May.



FIG. 79. *Phalaris amethystina* Trin.; Beal, Grasses N. Am., 2: 183. PURPLE CANARY-GRASS.—A stout annual 4 to 9 dm. high, with broad, flat leaves, and ovoid or oblong, densely-flowered terminal panicles.—Oregon to California and southward to Chile. June.

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FIG. 80. *Phalaris caroliniana* Walt. (*P. intermedia* Bosc.). SOUTHERN CANARY-GRASS.—A comparatively slender species 3 to 6 dm. high, with rather short, flat leaves, and ovoid, densely flowered, capitate panicles 2 to 5 cm. long.—River bottoms and wet places, South Carolina to Indian Territory, Texas, Nevada, California, and Oregon. April.



FIG. 81. *Phalaris angusta* Nees (*P. intermedia angusta* Chapm.). CALIFORNIA TIMOTHY.—A stout grass 6 to 14 dm. high, with narrow, densely flowered, spike-like panicles 6 to 12 cm. long.—In wet places, South Carolina and Louisiana to southern California. [South America.] May. Cultivated to a limited extent in the Southern States.

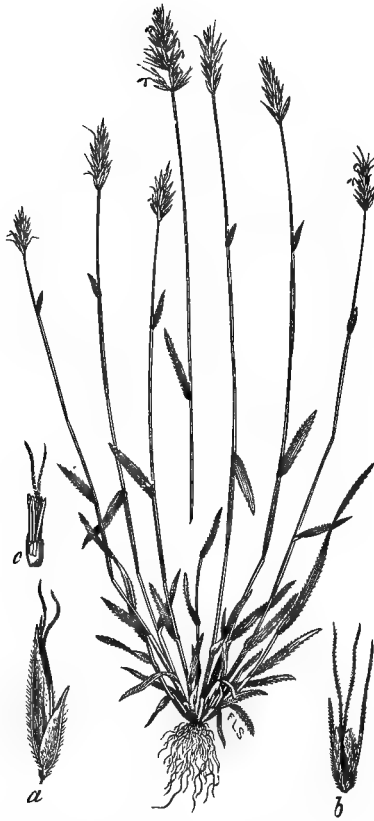


FIG. 82. *Anthoxanthum odoratum* L. SWEET VERNAL-GRASS.—A sweet-scented grass, with slender, erect, tufted culms, flat leaf-blades and narrow, spike-like terminal panicles.—Abundantly naturalized in lawns, fields, and waysides from Newfoundland and Ontario to North Carolina and Tennessee. [Europe, northwestern Asia, and northern Africa.] May–September.

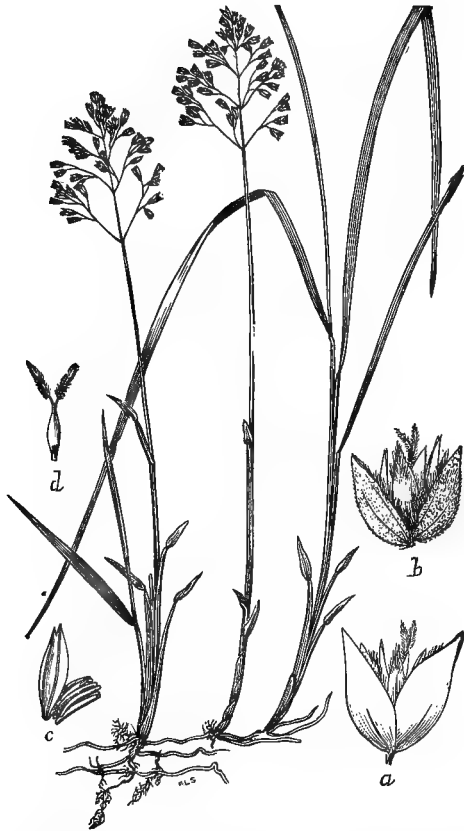


FIG. 83. *Savastana odorata* (L.) Scribn. (*Hierochloa borealis* R. & S.). VANILLA-GRASS.—A slender, sweet-scented, stoloniferous perennial 3 to 6 dm. high, with short culm-leaves and brownish, open panicles. The flat leaves of the sterile shoots are 1 to 3 dm. long.—Newfoundland and New Brunswick to southern New York, west to Minnesota and Iowa; in the Rockies from British America south to Arizona and Mexico; Alaska southward in the mountains to Oregon. [Cooler temperate regions and high mountains of both hemispheres.] April–August.



FIG. 84. *Savastana macrophylla* (Thurb.) (*Hierochloë macrophylla* Thurb.); Beal, Grasses N. Am., 2: 187. LARGE-LEAFED VANILLA-GRASS.—A rather stout, native perennial 6 to 10 dm. high, with long and broad leaves and loosely flowered panicles, usually about 4 inches long.—Coniferous woods, California and Oregon. March-May.

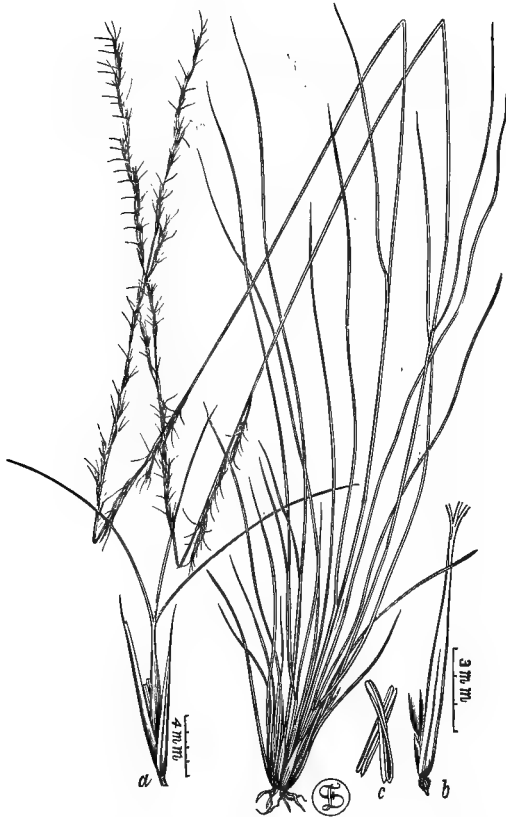


FIG. 85. *Aristida stricta* Michx. WIRE-GRASS.—A rigid, erect wiry perennial 6 to 12 dm. high, with narrow, involute leaves and strict, spike-like panicles about 30 cm. long.—Dry pine barrens near the coast, Virginia (?) and North Carolina to Mississippi, often covering extensive tracts and forming the bulk of the pasturage. July–October.



FIG. 86. *Aristida palustris* (Chapm.) Vasey (*A. virgata palustris* Chapm.). SWAMP POVERTY-GRASS.—An upright, rigid perennial 6 to 15 dm. high, with long, narrow leaves, and slender, interrupted, spicate panicles 30 to 70 cm. long.—Moist places near the coast in the pine barrens, South Carolina to Texas. [Cuba.] August–October.



FIG. 87. *Aristida gossypina* Bosc (*A. lanata* Poir.). WOOLLY POVERTY-GRASS.—A rather stout perennial, with simple stems 6 to 12 dm. high, and narrow panicles 30 to 60 cm. long. Lower sheaths usually woolly.—Dry pine barrens, mostly near the coast, Delaware to Texas and Indian Territory. September–November.



FIG. 88. *Aristida tuberculosa* Nutt. LONG-AWNED POVERTY-GRASS.—A rigid, much-branched perennial 3 to 4.5 dm. high, with nearly simple panicles 10 to 18 cm. long. The widely spreading, nearly equal awns 3 to 4 cm. long.—Dry, sandy soil, near the coast, Massachusetts to Mississippi; also in Illinois, Wisconsin, and Minnesota. August–October.



FIG. 89. *Stipa spartea* Trin. PORCUPINE-GRASS.—A stout, erect perennial, with simple culms 6 to 10 dm. high, long, narrow leaves and few-flowered panicles. The strong, twisted awns are 8 to 15 cm. long, and at the base of the flowering glume is a long, pointed, and bearded callus.—Prairies, Illinois to Colorado, north to Manitoba and British Columbia. June–August.

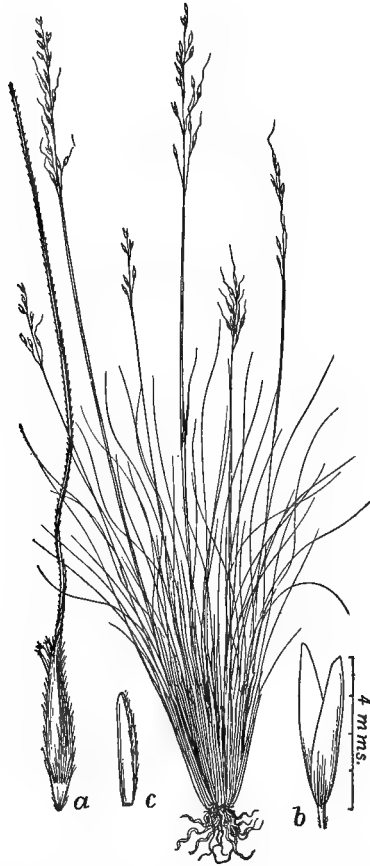


FIG. 90. *Stipa kingii* Boland. (*Oryzopsis kingii* Beal, Grasses N. Am., 2: 229).—A slender, erect, caespitose perennial 2 to 4 dm. high, with involute, filiform leaves and contracted panicles 8 to 12 cm. long. Awns scabrous.—California and (?) Nevada.



FIG. 91. *Stipa mongolica* Trin.; Beal, Grasses N. Am., 2 : 227 (sub *Oryzopsis*).—A slender, densely tufted perennial about 3 dm. high, with short, setaceous leaves and loosely few-flowered panicles. Awns plumose.—Mountains of Colorado. [Eastern Asia.]



FIG. 92. *Oryzopsis melanocarpa* Muhl. BLACK MOUNTAIN RICE.—A rather stout, long- and broad-leaved perennial 3 to 9 dm. high, with narrow, simple panicles of a few, large spikelets.—Open rocky woods, sometimes on cliffs, Quebec and Ontario to Delaware, Kentucky, Missouri, and Minnesota. July–September.



FIG. 93. *Oryzopsis asperifolia* Michx. WHITE MOUNTAIN RICE.—A slender perennial 1.5 to 5 dm. high, with narrow, simple panicles 6 to 10 cm. long. The basal leaves, which are 5 to 7 mm. wide, often overtop the culm.—Woods, Newfoundland, Massachusetts and New Jersey, to Minnesota and British Columbia, and southward in the Rockies to New Mexico. April–July.

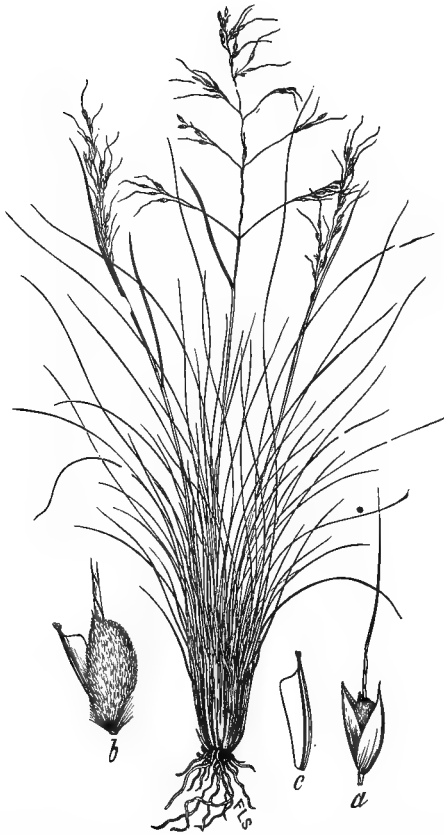


FIG. 94. *Oryzopsis fimbriata* (HBK.) Hemsl.; Beal, Grasses N. Am., 2: 231.—A slender, tufted perennial 5 to 8 dm. high, with very narrow, involute leaves and loosely flowered panicles 10 to 13 cm. long.—In canyons and under limestone cliffs, mountains of western Texas to California. [Mexico and Lower California.] July–September.

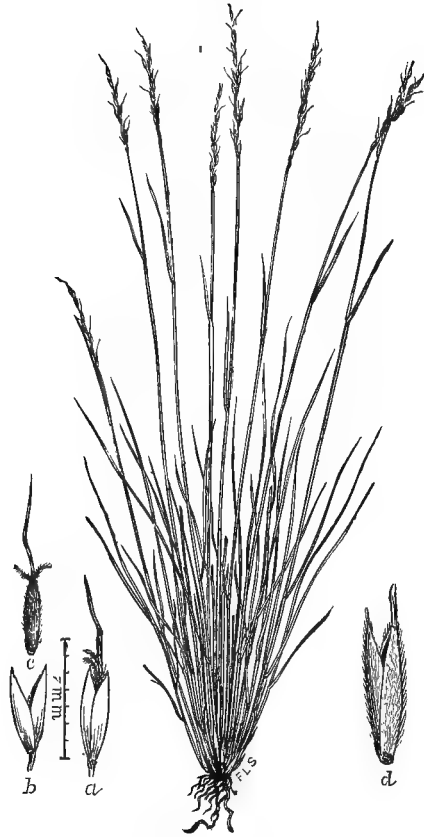


FIG. 95. *Oryzopsis exigua* Thurb.; Beal, Grasses N. Am., 2: 227. LITTLE MOUNTAIN RICE.—A slender native perennial 1.5 to 3 dm. high, with filiform leaves, and narrow, simple, few-flowered panicles 2 to 5 cm. long.—Among rocks in canyons and on mountain tops, Montana and Wyoming to Utah, Oregon, and Washington. June–August.

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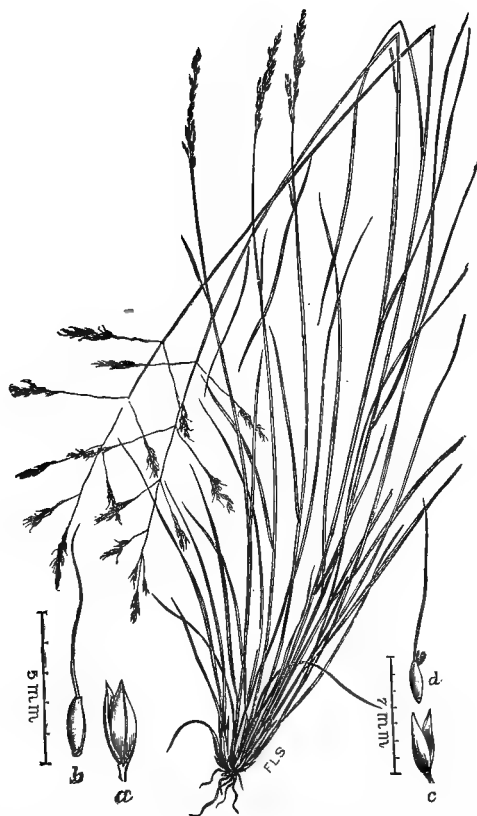


FIG. 96. *Oryzopsis micrantha* (Trin. & Rupr.) Thurb. SMALL-FLOWERED MOUNTAIN RICE.—A slender, erect perennial, usually about 6 dm. high, with narrow leaves and small-flowered, open panicles 8 to 16 cm. long.—Woods, river bluffs, and mountain sides, South Dakota to Nebraska, Colorado, New Mexico, and Arizona. June–August.

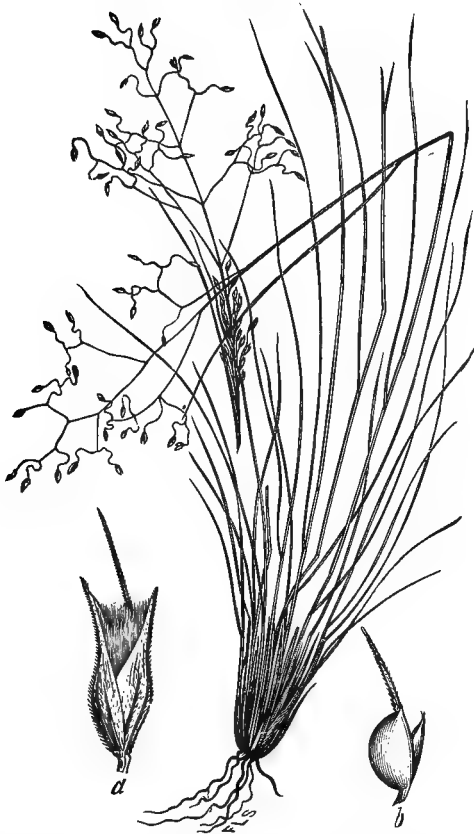


FIG. 97. *Eriocoma cuspidata* Nutt. (*Stipa membranacea* Pursh, not Linn.; *Oryzopsis membranacea* V.). INDIAN MILLET.—A native perennial, growing in bunches 3 to 7 dm. high, with narrow, involute leaves and peculiarly branched, diffuse panicles 12 to 15 cm. long.—Grassy slopes, dry hillsides, sandy river banks, about springs in deserts, in cultivated fields, etc., South Dakota to New Mexico, California, and British Columbia. [Mexico.] May-September.



FIG. 98. *Milium effusum* L. WILD MILLET.—A pale-green perennial, with simple culms 6 to 14 dm. high, broad, flat, spreading leaves and diffuse panicles 15 to 18 cm. long.—Woods and ravines, Cape Breton Island to western Ontario, Pennsylvania, Michigan, and Minnesota. [Europe, Asia.] June, July.



FIG. 99. *Muhlenbergia diffusa* Schreb. NIMBLE WILL.—A low, slender perennial, with ascending, much-branched wiry culms 3 to 6 dm. long, flat leaf-blades and narrow, rather densely flowered panicles.—In shade in thickets, borders of woods, waste ground about dwellings, etc., Maine and Ontario to Minnesota, Kansas, Texas, and Florida. [Mexico (?)] August-January (in Louisiana).



FIG. 100. *Muhlenbergia mexicana* (L.) Trin. MEXICAN DROP-SEED.—An upright or ascending, usually much-branched perennial 3 to 9 dm. high, with a scaly, creeping rootstock, numerous, flat leaf blades and contracted, densely flowered panicles.—Sandy or rocky banks of streams and low thickets, New Brunswick and Ontario to North Carolina, Indian Territory, and South Dakota.



FIG. 101. *Muhlenbergia tenuiflora* (Willd.) B. S. P. (*M. willdenovii* Trin.). SLENDER-FLOWERED DROPSEED.—An erect, simple or sparingly branched perennial 3 to 9 dm. high, with creeping, scaly rootstocks, flat leaf blades and rather few-flowered, linear panicles.—Rocky woods, Massachusetts to Ontario, Minnesota, Texas, Alabama, and Virginia. August, September.



FIG. 102. *Muhlenbergia sylvatica* Torr. WOODLAND DROP-SEED.—A perennial, usually much-branched grass 6 to 9 dm. high, with strong, scaly rootstocks, flat leaves and narrow, densely flowered panicles 5 to 15 cm. long.—In rocky woods, and wooded banks of streams, New Brunswick and Ontario to North Carolina, Tennessee, Texas, Kansas, and Minnesota. August–October.



FIG. 103. *Muhlenbergia racemosa* (Michx.) B. S. P.; Britton and Brown Ill. Fl., 1 : 143 (*M. glomerata* Trin.). WILD TIMOTHY.—A rather stout, upright perennial, with very tough and densely scaly rootstocks, nearly simple culms 6 to 9 dm. high, and densely flowered, narrow panicles 5 to 10 cm. long.—Moist meadows and low grounds, Newfoundland to New Jersey, Missouri, Arizona, and British Columbia. June–September.

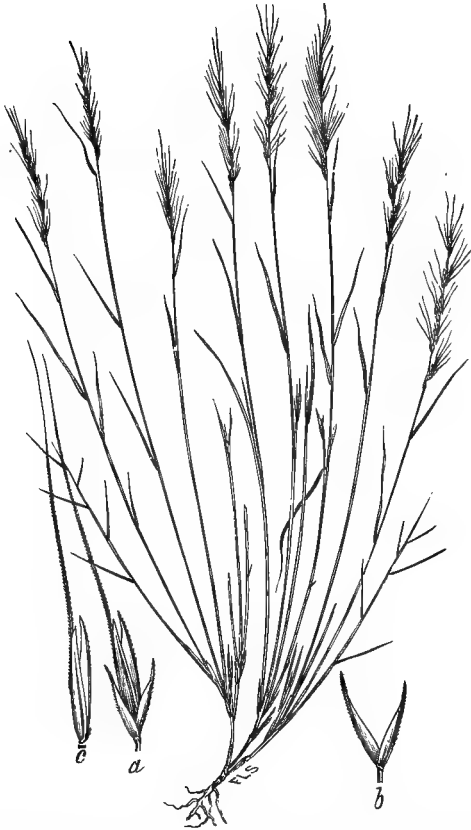


FIG. 104. *Muhlenbergia pringlei* Scribn.; Beal, Grasses N. Am., 2 : 257.—An erect, densely caespitose, wiry perennial, with simple culms 3 to 4 dm. high, involute-filiform leaves and slender, contracted, often purplish panicles 6 to 10 cm. long.—Canyons, basins, and shaded ledges, mountains of New Mexico and Arizona. [Mexico.] May-September



FIG. 105. *Muhlenbergia porteri* Scribn. in Beal, Grasses N. Am., 2 : 259 (*M. texana* Thurb. not Buckley).—A much-branched native perennial, with slender, somewhat wiry stems 3 to 6 dm. long, rather short, narrow leaves, and diffuse panicles. Valuable for grazing and for hay.—Dry mesas and table-lands, Texas to Arizona, Nevada, and California. [Mexico.] August, September.

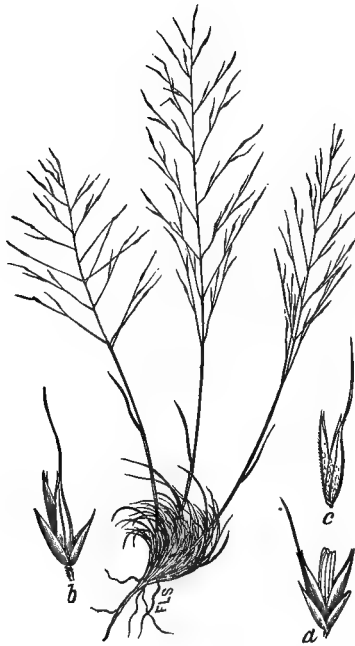


FIG. 106. *Muhlenbergia gracillima* Torr.; Beal, Grasses N. Am., 2: 261.—A densely tufted perennial, with slender culms 2 to 4 dm. high, numerous involute basal leaves and open capillary panicles 10 to 15 cm. long.—Dry plains, Kansas to Colorado, Texas, and Arizona. July–October.



FIG. 107. *Muhlenbergia pungens* Thurb.; Britton and Brown, Ill. Fl., 1: 146.—A rigid, native perennial 3 to 4.5 dm. high, with firm, sharp-pointed leaves and open panicles about 15 cm. long.—Dry soil, sand hills and plains, Nebraska to Utah, Texas and Arizona. July–October.



FIG. 108. *Muhlenbergia filiculmis* Vasey; Contrib. U. S. Nat. Herb. 1 : 267; Beal, Grasses N. Am., 2 : 250. THREAD-LIKE MUHLENBERGIA.—A low, tufted perennial with filiform scape-like culms 1.5 to 3.5 dm. high, setaceous radical leaves and narrow, spike-like panicles 2 to 5 cm. long.—Sandy soil, Ute Pass, El Paso County, in moist prairies at Como, Park County, and on the mesas at Twin Lakes, Lake County, Colorado; alt. 2,000 to 3,000 m. July-September.

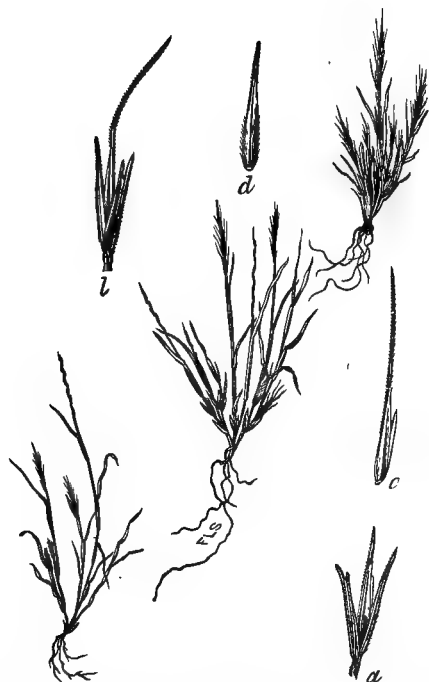


FIG. 109. *Muhlenbergia schaffneri* Fourn; Beal, Grasses N. Am., 2: 239.—A low, caespitose, branching annual 2 to 10 cm. high, with short leaves and simple, spike-like panicles. Awn or the flowering glume 1 to 7 lines long.—“Dry, gravelly patches of thin soil,” mountains of Arizona and New Mexico. [Mexico.] September.



FIG. 110. *Muhlenbergia virescens* (HBK.) Trin.; Beal, Grasses N. Am., 2: 242.—A rather slender, erect perennial about 6 dm. high, with long, narrow leaves and a strict, pale-green or straw-colored panicle about 15 cm. long.—At an altitude of 1,800 to 2,400 m. on the mountains of Arizona and New Mexico. [Mexico.] May, June.



FIG. 111. *Muhlenbergia gracilis* Trin.; Beal, Grasses N. Am., 2: 242.—A slender, but rather rigid, densely caespitose perennial 1.5 to 6 dm. high, with narrow, involute leaves, and contracted panicles 8 to 15 cm. long.—Ascending to 2,700 m. or more. Texas to Arizona, Colorado, and Wyoming. [Mexico.] June–September. 18337—No. 7—9

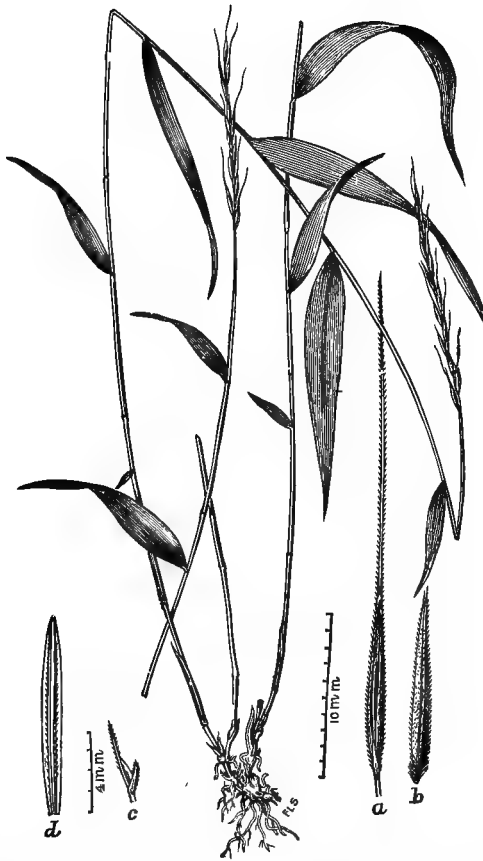


FIG. 112. *Brachyelytrum erectum* (Schreb.) Beauv. (*B. aristatum* R. & S.). BEARDED SHORT-HUSK.—A perennial, with simple culms 3 to 9 dm. high, flat, spreading leaf blades and few-flowered, simple, terminal panicles.—Open, rocky woods, Newfoundland to North Carolina, Alabama, Missouri, and Minnesota and Ontario. May–August.



FIG. 113. *Heleocholea schænoides* (L.) Host (*Phleum schænoides* L.; *Crypsis schænoides* Lam.). RUSH-LIKE TIMOTHY.—A diffusely branching caespitose annual 1 to 3 dm. high, with inflated sheaths, rather short, spreading leaves, and densely flowered ovate, or oblong, spike-like panicles.—Waste ground about New York City, Philadelphia, etc., sparingly naturalized. [Europe and Asia.] July, August.



FIG. 114. *Phleum pratense* L. TIMOTHY.—A perennial with erect, simple culms 3 to 12 dm. high and dense, cylindrical, spike-like panicles 2.5 to 10 cm. long.—Widely cultivated and completely naturalized in fields, waysides, and waste ground throughout the United States and British America. [Europe and Asia.] June-August.



FIG. 115. *Alopecurus geniculatus* L. FLOATING FOXTAIL.—A slender perennial, with culms decumbent and branched at base, then erect or ascending, 1.5 to 6 dm. high, flat, spreading leaves and dense, spike-like, slender panicles 2.5 to 7.5 cm. long.—Wet meadows, banks of streams and ditches throughout the United States, and from Newfoundland to British Columbia. [Europe and Asia.] April–September.



FIG. 116. *Alopecurus pratensis* L. MEADOW FOXTAIL.—An erect, smooth perennial 3 to 9 dm. high, with short, creeping root-stocks, flat, spreading leaf blades, and dense, cylindrical, spike-like panicles 5 to 10 cm. long.—Naturalized in fields and meadows, Labrador to southern New York, Ohio and Michigan; also Oregon, Idaho, and California. [Europe, Asia, and Africa.] June, July.



FIG. 117. *Alopecurus occidentalis* Scribn. (*A. pratensis alpestris* A. Gray). MOUNTAIN FOXTAIL.—An erect, rather slender grass 6 to 9 dm. high, with shorter and thicker heads than those of Meadow Foxtail.—Wet meadows and banks of streams, high mountains of Montana, Idaho, Wyoming, and Colorado. June–September. A valuable hay grass.



FIG. 118. *Phippsia algida* (Soland.) R. Br.; Britton and Brown, Ill. Fl., 1: 150. *PHIPPSIA*.—A low, tufted, glabrous perennial 2 to 10 cm. high, with narrow, soft, and flat leaves and contracted, simple panicles.—Arctic North America and on the highest mountain peaks of Colorado. [Greenland, arctic Europe, and Asia.] July, August.



FIG. 119. *Sporobolus asper* (Michx.) Kunth (*Agrostis asper* Michx.). PRAIRIE-GRASS.—A rather slender perennial 3 to 9 dm. high, with usually long, involute-filiform leaf blades and contracted, linear panicles 5 to 15 cm. long.—In dry, sandy soil, open woods and glades, Long Island to Florida, west to Texas, Missouri, and Illinois. August–October. Avoided by stock excepting when young.



FIG. 120. *Sporobolus longifolius* (Torr.) Wood; Britton and Brown, Ill. Fl., 1: 151. LONG-LEAFED SPOROBOLUS.—A stout perennial 3.5 to 10 dm. high, with very long, attenuate-pointed leaves, and strict, spike-like panicles 3 to 10 inches long, which are more or less included in the inflated leaf sheaths.—Dry, sandy soil, Maine to Pennsylvania, South Dakota and Utah, south to Texas and Florida. August–October.



FIG. 121. *Sporobolus heterolepis* A. Gray. STRONG-SCENTED SPOROBOLUS.—A rather stout, somewhat wiry, caespitose perennial 6 to 9 dm. high, with very long basal leaves and loose, open panicles.—In dry soil, prairies, etc., Connecticut to Quebec, Iowa and Nebraska and Wyoming, thence south to Texas and north to Assiniboia and Saskatchewan. August, September.



FIG. 122. *Sporobolus interruptus* Vasey; Beal, Grasses N. Am., 2: 286.—A rather stout, erect perennial with simple culms about 4 dm. high, flat leaves and narrow but loosely flowered panicles 10 to 18 cm. long.—In forests, mountains of Arizona. August, September.



FIG. 123. *Sporobolus floridanus* Chapm.—A rather stout, erect perennial 6 to 12 dm. high, with long, narrow leaves and diffuse panicles 2.5 to 5 cm. long. Pedicels capillary; spikelets purplish.—Moist pine barrens near the coast, North Carolina to western Florida. July–September.



FIG. 124. *Sporobolus curtissii* (Vasey) Small. (*S. floridanus curtissii* Vasey; Beal, Grasses N. Am., 2 : 290).—A wiry, erect perennial 3 to 6 dm. high, with very long leaves and loosely flowered, open panicles 15 to 25 cm. long.—Moist pine barrens, northeastern Florida. July–November.

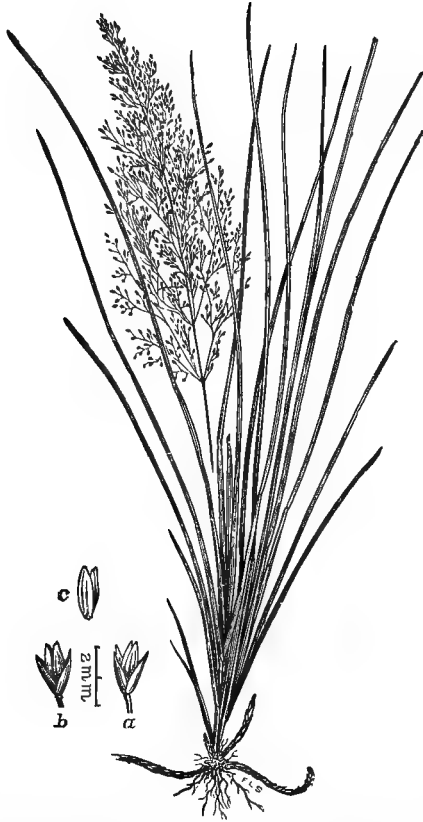


FIG. 125. **Sporobolus compressus** (Torr.) Kunth. (*Agrostis compressa* Torr.). FLAT-STEMMED SPOROBOLUS.—A caespitose perennial, with short, scaly rootstocks, flattened culms 3 to 6 dm. high, rather long, conduplicate leaves and open, capillary panicles 10 to 30 cm. long.—In bogs and pine barrens, Long Island and New Jersey. September, October.



FIG. 126. *Sporobolus indicus* (L.) R. Br. SMUT-GRASS.—A tufted, wiry, erect perennial 3 to 9 dm. high, with simple culms and narrow, densely flowered, spike-like panicles 10 to 30 cm. long.—Abundantly naturalized in waste ground, waysides, fields, and pastures, Virginia and Tennessee to Florida, Arkansas, Texas, and California; occasional in the Eastern cities. [Native or naturalized in all tropical countries.] March–September.



FIG. 127. *Sporobolus airoides* Torr. FINE-TOP SALT-GRASS.— A stout, coarse, and rigid perennial 3 to 9 dm. high, with long, narrow leaves and open, spreading panicles of many small spikelets.— Moist or dry, usually saline or alkaline soil in deserts, prairies, along streams, in meadows, etc., Nebraska and Kansas to Idaho, California, Texas, and Arizona. [Mexico and Lower California.] July–September.

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FIG. 128. *Sporobolus argutus* (Nees) Kunth (*Vilfa arguta* Nees.); Beal, Grasses N. Am., 2: 301.—A caespitose perennial 2 to 4 dm. high, with flat leaves and open (at first strict) panicles 3 to 5 cm. long.—“Sand dunes and sandy flats near river banks,” Kansas and Colorado to Texas and western Louisiana, also in southern Florida. [Mexico and West Indies.] May–September.



FIG. 129. *Sporobolus confusus* (Fourn.) Vasey; Beal, Grasses N. Am., 2 : 294.—A slender, branching, tufted annual 0.8 to 2 dm. high, with loose sheaths, flat leaves, and capillary, ovoid or oblong panicles 8 to 15 cm. long.—Sandy banks of streams, moist places in sandy plains, canyons, etc., Texas to California, and in Colorado and Montana. [Mexico.] July–September.



FIG. 130. *Epicampesrigens* (Boland.) Benth.; Beal, Grasses N. Am., 2: — (*Cinna macroura* Thurb. not Kunth; *Vilfa rigens* Boland. not Trin.). DEER-GRASS.—A stout, erect perennial, with rigid, wiry culms 9 to 12 dm. high; long, narrow leaves and very long, narrow, and densely flowered spike-like panicles.—In the foothills, Texas to Nevada, New Mexico, Arizona, and southern California. [Mexico.] July–November. A bunch-grass of some agricultural value.

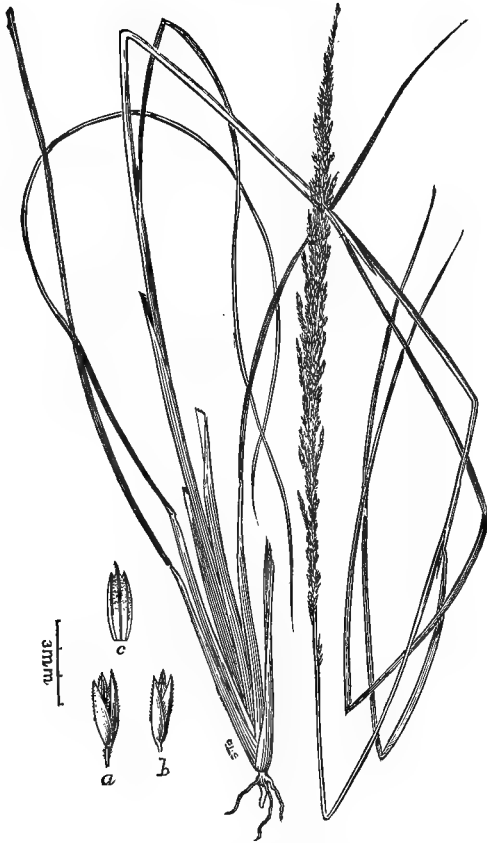


FIG. 131. *Epicampes ligulata* Scribn. sp. nov.—A stout, rigid perennial 6 to 12 dm. high, with narrow, very scabrous leaves and strict, rather densely flowered panicles 20 to 40 cm. long. Leaves long-attenuate pointed, rigid, and subinvolute at the base, where they are much narrower than the rigid ligule, which is 10 to 30 mm. long. Spikelets dark purple, glumes subequal.—Cool slopes and canyons, mountains of New Mexico and Arizona. [Mexico.] August, September.



FIG. 132. *Polypogon monspeliensis* (L.) Desf. BEARD-GRASS.—A smooth annual from a few centimeters to 6 to 9 dm. high, with awned 1-flowered spikelets crowded in dense spike-like panicles.—In fields and waste places, sparingly naturalized along the Atlantic Coast from New Hampshire to South Carolina; abundantly on the Pacific Slope from California to Vancouver Island, and in Arizona, Nevada, and Colorado. [Europe and Asia.] April–October.



FIG. 133. *Limnodia arkansana* (Nutt.); Dewey in Contrib. U. S. Nat. Herb., 2: 518 (*Greenia arkansana* Nutt.; *Thurberia arkansana* Benth.).—A slender annual 2 to 6 dm. high, more or less geniculate at the lower nodes, with soft, flat leaves and narrow, loosely flowered panicles 8 to 18 cm. long. Outer glumes scabrous or pilose.—Shell banks, woods, etc., western Florida to Arkansas and southern Texas. April–June.



FIG. 134. *Cinna arundinacea* L. INDIAN REED.—A tall, leafy grass 9 to 21 dm. high, with simple culms, flat leaf blades, and ample terminal panicles.—Shaded swamps, banks of streams and low thickets, Newfoundland to North Carolina, Alabama, Texas, South Dakota, and the Northwest Territory. May-September.



FIG. 135. *Agrostis humilis* Vasey (*A. varians* Trin. ? not Thuill.). —A dwarf, slender perennial 6 to 12 cm. high, with short, flat leaves and contracted, purplish panicles 2 to 3 cm. long.—Moist meadows, or mossy and springy places, at 2,100 to 3,000 m. altitude on the mountains of Colorado, Wyoming, Washington, Oregon, and Montana. August, September.



FIG. 136. *Agrostis coarctata* Ehrh. (*Stolonifera coarctata* Reichb).—A creeping perennial with slender culms, the upright branches about 3 dm. high, short, flat leaves and narrow, rather densely flowered panicles 5 to 10 cm. long.—Damp soil and sands along the coast, Newfoundland to New Jersey. [Europe.] July–October. A fine-leaved, excellent turf-forming species, valuable for lawns.



FIG. 137. *Agrostis densiflora* Vasey; Contrib. U. S. Nat. Herb., 3: 72 (1892); Beal, Grasses N. Am., 2: 326. DENSELY-FLOWERED BENT.—A rather stout, caespitose perennial 1.5 to 4.5 dm. high, with short and comparatively broad leaves and densely, many-flowered, almost spike like panicles 3 to 8 cm. long.—Oregon and California, along the coast, apparently rare. July, August.



FIG. 138. *Agrostis pringlei* Scribn. sp. nov.—A strongly stoloniferous grass, with rather slender, upright or ascending culms 3 to 6 dm. high, narrow and rather rigid flat leaves, and loosely flowered, narrow panicles 5 to 15 cm. long. Flowering glumes much shorter than the acuminate outer ones, and remarkable for the long hairs on the callus.—Plains, Mendocino County, California (Pringle), and northward to Oregon (?). August.



FIG. 139. *Agrostis diegoensis* Vasey (*A. foliosa* Vasey); Beal, Grasses N. Am., 2: 328.—A strong-growing, leafy perennial 6 to 10 dm. high, from creeping rootstocks, with pale-green, narrow, and many-flowered panicles 15 to 20 cm. long. Spikelets 2 to 3 mm. long; flowering glume short-awned or awnless; palea wanting.—Mountains of southern California to Washington. May–August.



FIG. 140. *Agrostis eliottiana* Schult. (*A. arachnoides* Ell.). SPIDER BENT-GRASS.—A low, branching annual, rarely exceeding 3 dm. high, with narrow, flat leaves and diffuse, capillary panicles. The flowering glume bears a long and very slender awn.—Dry hillsides and old fields, South Carolina to Kentucky and Missouri, south to Florida and Texas. April, May.



FIG. 141. *Gastridium lendigerum* (L.) Gaudin. (*G. australe* Beauv.; *Milium lendigerum* Linn.). NIT-GRASS.—A smooth annual 1.5 to 6 dm. high, with flat leaves and a strict, spike-like panicle 6 to 12 cm. long; cultivated for ornament.—Hills, naturalized, California and Oregon; also in Texas. [Southern Europe.] June, July.



FIG. 142. *Calamagrostis crassiglumis* Thurb.; Beal, Grasses N. Am., 2: 353 (as a var. of *C. neglecta*).—A rigid, erect perennial 1.5 to 4 dm. high, from creeping rootstocks, with long basal leaves and dense, oblong, spike-like panicles 4 to 6 cm. long.—Wet ground and gravelly lake shores, California to Vancouver Island. July, August.

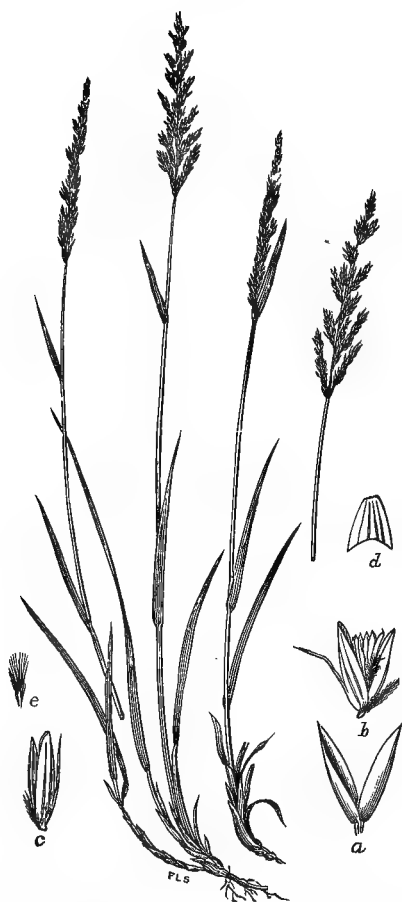


FIG. 143. *Calamagrostis breviseta* (A. Gray) Scribn.; Britton and Brown Ill. Fl., 1: 164 (*C. pickeringii* A. Gray). SHORT-AWNED REED-GRASS.—A slender perennial 3 to 5 dm. high, with flat leaves and narrow or subpyramidal, rather densely flowered purplish panicles 8 to 12 cm. long.—Moist ground, Newfoundland, Cape Breton Island, and Labrador to New Hampshire, Vermont, and Massachusetts. July, August.



FIG. 144. *Calamagrostis deschampsioides* Trin.; Beal, Grasses N. Am., 2: 339.—A slender perennial with culms 1.5 to 3 dm. high, from creeping rootstocks, with narrow leaves 3 to 7 cm. long and open, pyramidal panicles 4 to 8 cm. long.—Pribilof Islands, Alaska, southward to California. [Kamchatka.] August.



FIG. 145. *Calamagrostis aleutica* Trin.; Beal, Grasses N. Am., 2 : 346.—A stout, erect perennial 6 to 15 dm. high, with long and rather stiff, flat leaves and densely many-flowered, narrow panicles 15 to 30 cm. long.—Along the seashore, in rocky or marshy places, Alaska and Unalaska to California. June-September.



FIG. 146. *Calamagrostis tweedyi* Scribn.; Beal, Grasses N. Am., 2: 348.—A stout perennial 7 to 10 dm. high, with rather broad, flat leaves and densely flowered, spike-like panicles 8 to 12 cm. long.—Cascade Mountains, Washington.



FIG. 147. *Calamagrostis bolanderi* Thurb.; Beal, Grasses N. Am., 2: 352.—A stout perennial 6 to 15 dm. high, with flat leaves 10 to 30 cm. long and expanded, dark-purple panicles 8 to 20 cm. long.—Moist woodlands, northwestern California. August.

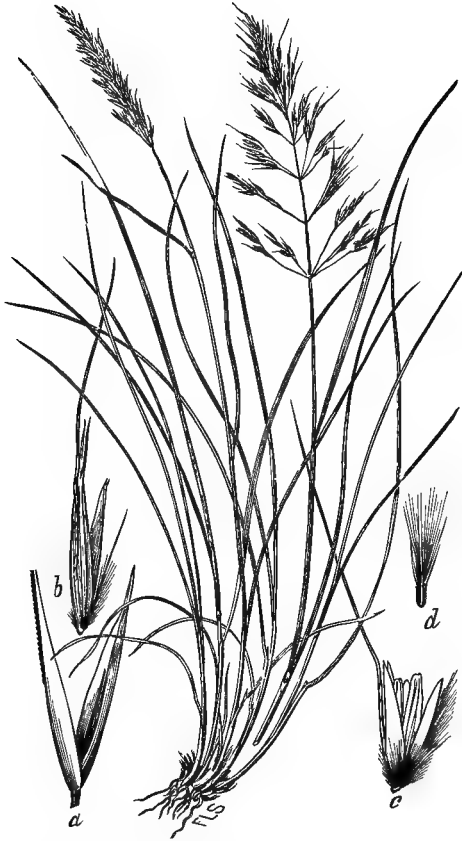


FIG. 148. *Calamagrostis howellii* Vasey; Beal, Grasses N. Am., 2: 339.—A densely caespitose, erect, leafy perennial 2.5 to 5 dm. high, with long and narrow basal leaves and open panicles 8 to 15 cm. long. Spikelets long-awned.—High mountains, Oregon and Washington. June–August.

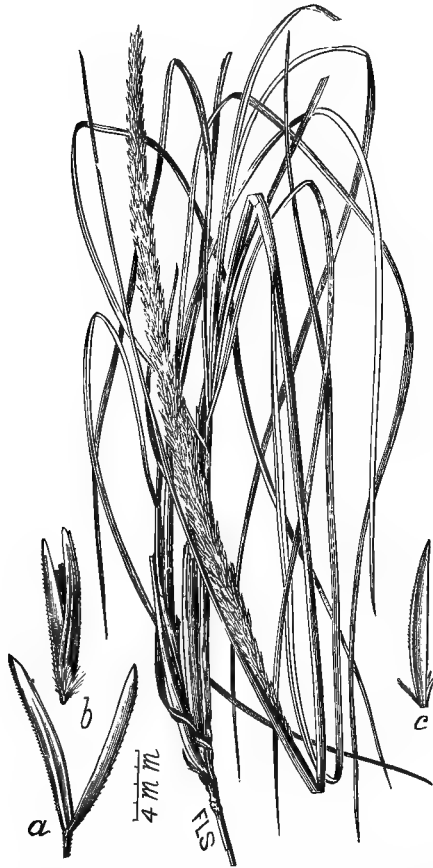


FIG. 149. *Ammophila arenaria* (L.) Link (*A. arundinacea* Host.). BEACH-GRASS, MARRAM-GRASS.—A coarse, erect perennial, with creeping rootstocks, rigid culms 6 to 12 dm. high, long leaves, and narrow, densely flowered, spike-like terminal panicles 12 to 25 cm. long.—Sandy coasts of the Atlantic from New Brunswick south to Virginia, and shores of the Great Lakes. [Europe.] July–October.



FIG. 150. *Calamovilfa brevipilis* (Torr.) Scribn. (*Arundo brevipilis* Torr.). SHORT-HAIRED REED-GRASS.—A rather slender, smooth perennial 9 to 12 dm. high, with very narrow leaves and open panicles 8 to 24 cm. long.—Sandy swamps in the pine barrens of New Jersey. August, September.



FIG. 151. *Holcus lanatus* L. VELVET GRASS.—A perennial 3 to 6 dm. high, with creeping rootstocks, flat leaves, and open panicles 5 to 8 cm. long; usually densely pubescent all over with soft, whitish hairs.—Introduced into this country from Europe with other grasses and now widely distributed. May–August.



FIG. 152. *Aira caryophyllea* L. SILVERY HAIR-GRASS.—A slender, tufted annual 1 to 3 dm. high, with short leaves and small-flowered, open panicles 2 to 8 cm. long.—In sandy waste places, Massachusetts to Virginia; also on the Pacific Coast. Introduced from Europe. May–August.



FIG. 153. *Aira præcox* L. EARLY WILD OAT-GRASS.—A tufted, erect or ascending annual 2 to 12 cm. high, with a contracted panicle 1 to 2 cm. long.—Introduced and sparingly distributed in the Middle States near the coast, growing in sandy soil. Also on Vancouver Island. [Europe.] May–July.



FIG. 154. *Deschampsia holciformis* Presl.; Beal, Grasses N. Am., 2: 370. CALIFORNIAN HAIR-GRASS.—A stout, erect perennial 6 to 15 dm. high, with long and rather rigid basal leaves and densely flowered, more or less interrupted panicles 12 to 24 cm. long.—Moist meadows, California near the coast. April.



FIG. 155. *Deschampsia flexuosa* (L.) Trin. TUFTED HAIR-GRASS.—A slender, erect perennial about 6 dm. high, with involutesetaceous, radical leaves and diffuse panicles.—Labrador southward along the mountains to North Carolina and Tennessee, and westward from New York to Wisconsin. [Greenland and Europe.] May–August.



FIG. 156. *Deschampsia elongata* (Hook.) Munro; Beal, Grasses N. Am., 2: 371. **SLENDER HAIR-GRASS.**—A slender perennial 3 to 12 dm. high, with narrow panicles 15 to 38 cm. long.—Montana to British Columbia and southward on the Pacific Slope to Mexico. May–August.



FIG. 157. *Deschampsia calycina* Presl (*Aira danthonioides* Trin.). OAT-LIKE HAIR-GRASS.—A rather slender, erect, caespitose grass from 1 to 7 dm. high, with more or less spreading panicles.—Native along the Pacific Slope from Canada to California, eastward to Utah, and southward through Mexico to Peru. April-July.



FIG. 158. *Deschampsia atropurpurea* (Wahl.) Scheele. MOUNTAIN HAIR-GRASS.—A slender, alpine grass 1.5 to 4 dm. high, with flat leaves and few-flowered, nodding panicles 3 to 12 cm. long.—Labrador, White Mountains, Adirondacks, Rocky Mountains in Colorado, northward to Alaska. [Northern Europe and Asia.] July–September.



FIG. 159. **Trisetum palustre** (Michx.) Torr. MARSH OAT-GRASS.—A slender, loosely tufted perennial 6 to 9 dm. high, with flat, soft leaves and loosely flowered, nodding, and yellowish green panicles.—On moist rocks, along brooks, in wet meadows, etc., Massachusetts to Illinois, south to Florida and Louisiana; British Columbia. April–June.

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FIG. 160. **Trisetum subspicatum** (L.) Beauv. (*Aira subspicata* L.). DOWNY OAT-GRASS.—A slender, erect perennial 1.5 to 4.5 dm. high, with usually downy culms and leaves and densely many-flowered, spike-like panicles.—Widely distributed in the cooler temperate regions of both hemispheres, ranging in North America from Labrador to Alaska and extending southward in the Eastern States to the mountains of North Carolina and Tennessee, and in the West to New Mexico and California. June-September.



FIG. 161. *Trisetum montanum* Vasey; Beal, Grasses N. Am., 2: 379. ROCKY MOUNTAIN OAT-GRASS.—A slender, erect, or ascending native grass 3 to 8 dm. high, with narrow, flat leaves and many-flowered, more or less contracted panicles 8 to 12 cm. long.—Mountains of Colorado and New Mexico. July, August.



FIG. 162. *Trisetum interruptum* Buckl.; Beal, Grasses N. Am., 2: 376, under *T. elongatum*. SLENDER OAT-GRASS.—A slender, erect annual 2 to 5 dm. high, with rather short, soft leaves and narrow, elongated panicles 4 to 10 cm. long.—Colorado to Texas, Arizona, and southern California. March-May.



FIG. 163. *Trisetum canescens* Buckl.; Brewer and Wats., Bot. Calif., 2: 296. SILVERY OAT-GRASS.—An erect perennial 3 to 12 dm. high, with flat leaves, and more or less densely flowered panicles 12 to 18 cm. long.—In dry, open ground, open woods, thickets, and wet meadows, California to British Columbia, east to Montana. May–September.



FIG. 164. *Trisetum cernuum* Trin.; Beal, Grasses N. Am., 2: 379. NODDING OAT-GRASS.—A slender perennial 6 to 10 dm. high, with rather broad, flat leaves and loosely flowered, nodding panicles 12 to 20 cm. long.—Alaska to northern California and eastward to Idaho. May–July.

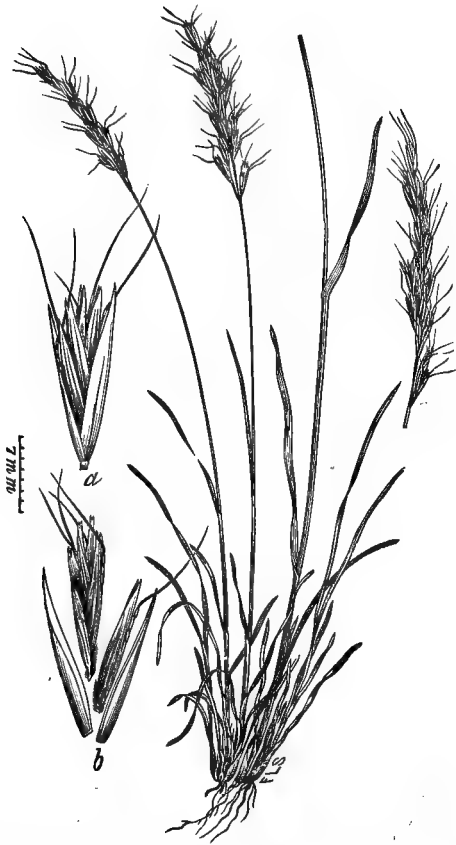


FIG. 165. *Avena americana* (Scribn.) (*A. pratensis* var. *americana* Scribn.; *A. hookeri* Scribn.). AMERICAN OAT.—A rigidly erect perennial 3 to 6 dm. high, with narrow, firm leaves, and contracted panicles 8 to 12 cm. long.—Open thickets and prairies, Manitoba, and in the foothills of the Rocky Mountains southward to Colorado. June–August.



FIG. 166. *Avena mortoniana* Scribn.; Bot. Gaz., 21: 133. MORTON'S OAT-GRASS.—A densely caespitose, erect perennial 1 to 2.5 dm. high, with rather rigid leaves and narrow, simple panicles of one- to two-flowered spikelets.—At 3,900 to 4,200 m. altitude, mountains of Colorado. August.



FIG. 167. *Arrhenatherum elatius* (L.) Beauv. (*Avena elatior* L.). TALL OAT-GRASS.—A loosely tufted perennial 6 to 12 dm. high, with flat leaves and narrow, loosely flowered panicles 15 to 20 cm. long.—Introduced from Europe as a fodder grass. Valuable; in Europe regarded as one of the best meadow grasses. May, June.



FIG. 168. *Danthonia spicata* (L.) Beauv. (*Avena spicata* L.). WILD OAT-GRASS.—A smooth, slender, erect perennial 2.5 to 5 dm. high, with a few-flowered, narrow panicle spreading only in flower.—Common in dry, thin soils from Canada southward to the Gulf States and westward to Texas. May–September.



FIG. 169. *Danthonia compressa* Austin. TENNESSEE OAT-GRASS.—A slender, erect, tufted perennial 2 to 6 dm. high, with long, narrow root leaves, and few-flowered open panicles.—Mountain regions of eastern Tennessee and North Carolina northward to Canada. June–August.



FIG. 170. *Danthonia sericea* Nutt. SILKY OAT-GRASS.—A rather stout, erect perennial 3 to 9 dm. high, with usually pubescent sheaths, rather rigid leaves, large spikelets, and terminal, few-flowered panicles.—Open woodlands in dry soil, Massachusetts and New Jersey to Florida and west to Tennessee and Alabama. May, June.



FIG. 171. *Capriola dactylon* (L.) Kuntze (*Panicum dactylon* L.; *Cynodon dactylon* Pers.). BERMUDA-GRASS.—A creeping perennial, with upright or ascending, leafy flowering branches 1 to 6 dm. high.—Widely dispersed over the tropical and warmer temperate regions of the world, in the United States from Pennsylvania southward to Florida and westward to Texas and California. April–October. (The name *Capriola* may belong to *Panicum sanguinale*.)



FIG. 172. *Spartina polystachya* (Michx.) Ell. (*Trachynotia polystachya*). SALT REED-GRASS.—A stout, erect perennial 12 to 27 dm. high, with long, flat leaves and terminal panicles of twenty to fifty crowded, ascending spikes 5 to 10 cm. long.—Brackish marshes along the coast, Maine to Mississippi. July–October.



FIG. 173. *Spartina cynosuroides* (L.) Willd. FRESHWATER CORD-GRASS.—A stout, erect grass 6 to 18 dm. high, with unbranched, smooth culms from strong, scaly, creeping rootstocks, long, tough leaf blades, and five to twenty spikes, forming a terminal panicle.—River banks and lake shores, also brackish coast marshes, Maine and Nova Scotia to Assiniboia and Oregon, south to New Jersey, western Tennessee, Texas, and Colorado. July–October.

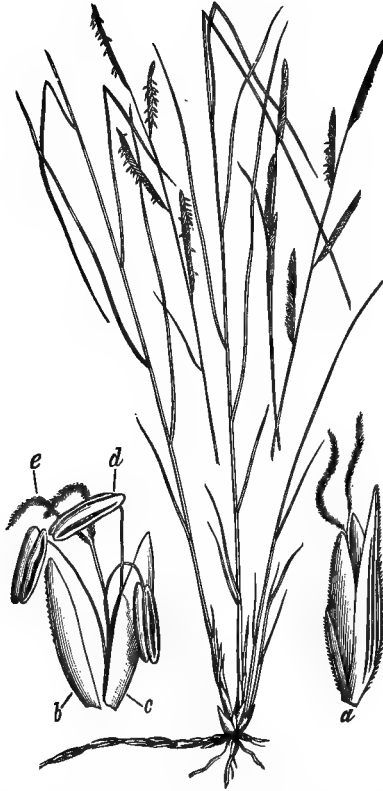


FIG. 174. *Spartina patens* (Ait.) Muhl. (*Dactylis patens* Ait.; *Spartina juncea* Ell.). FOX-GRASS.—A rather slender and somewhat wiry grass 3 to 6 (rarely 9) dm. high, with two to four slender, erect or widely spreading spikes.—Salt marshes and sandy shores along the coast from Newfoundland to Florida and westward to Texas. June–September.

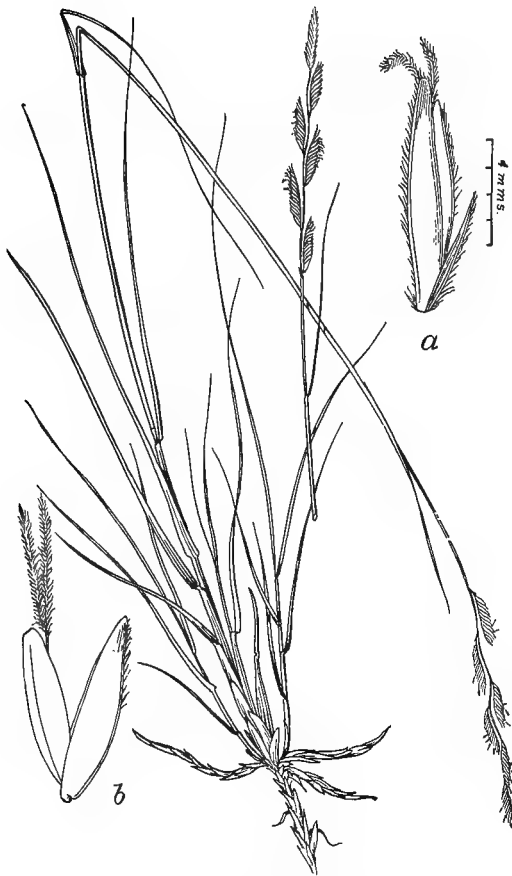


FIG. 175. *Spartina gracilis* Trin. WESTERN CORD-GRASS.—A comparatively slender, perennial species 3 to 9 dm. high, with flat leaves, and three to nine rather short, appressed spikes.—Meadows, swamps, and river bottoms, especially in alkaline soils, South Dakota to Kansas, west to British Columbia, Nevada, and California. March–August.

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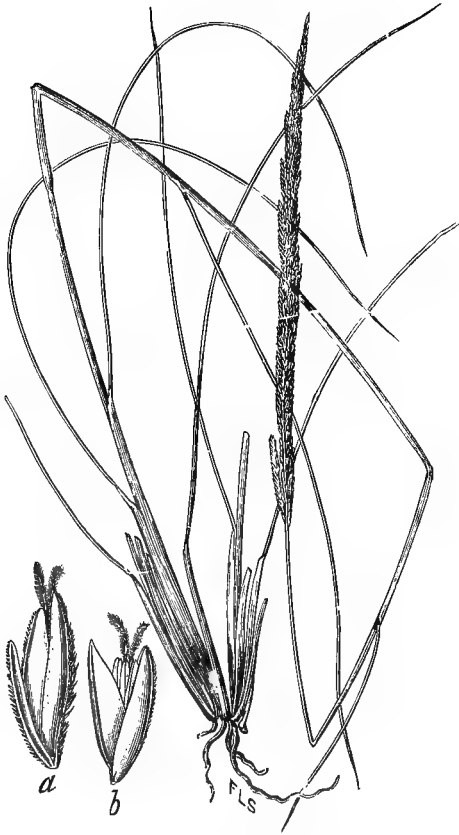


FIG. 176. *Spartina junciformis* Engelm. & Gray (*S. densiflora* Brongn. (?); *S. gouini* Fourn.); Beal, Grasses N. Am., 2: 400. RUSH-LIKE SPARTINA.—A stout perennial 6 to 15 dm. high, with very long, narrow leaves and short, appressed spikes, which form a cylindrical, spike-like inflorescence 10 to 30 cm. long.—Brackish marshes along the Gulf Coast, Key West, Florida to Texas. [Mexico and Chile. ?] June–October.



FIG. 177. *Spartina striota maritima* (Walt.) Scribn. (*Dactylis maritima* Walt.; *Spartina glabra* Muhl.). CREEK SEDGE or THATCH.—An erect and often stout salt-marsh grass from 6 to 24 dm. high, with long, flat leaves and few to many, erect, appressed spikes.—Along ditches and creeks of the salt marshes of both the Atlantic and Pacific coasts. July–October.



FIG. 178. *Campulosus aromaticus* (Walt.) Trin. (*Ægilops aromatica* Walt.; *Ctenium americanum* Spreng.). TOOTHACHE-GRASS.—An erect perennial 9 to 12 dm. high, from strong, lemon-scented and pungent rootstocks, with narrow leaves and usually a single, terminal, curved, pectinate spike 4 to 10 cm. long.—Southern Virginia to Florida and westward to Mississippi. July, August.

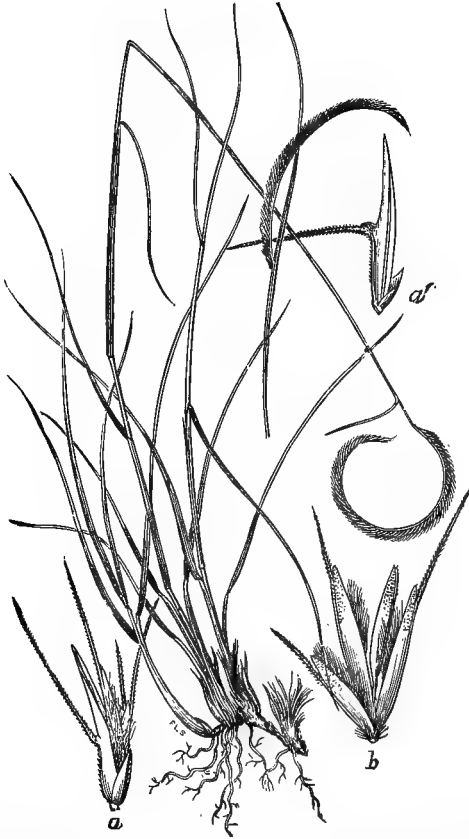


FIG. 179. *Campulosus chapadensis* Trin. (*Ctenium chapadense* Doell).—An erect perennial 8 to 12 dm. high, with narrow leaves and usually single, terminal, more or less curved spikes. More slender than *C. aromaticus*, with narrower glumes, and more delicate and longer awns.—Florida, in the “flat woods” regions. July–October.



FIG. 180. *Chloris glauca* (Chapm.) Vasey (*Eustachys glauca* Chapm.); Beal, Grasses N. Am., 2: 408. SMOOTH CHLORIS.—A strong-growing perennial, with diffusely spreading and ascending culms 6 to 12 dm. long, bearing 10 to 25 slender terminal spikes. Culms and sheaths strongly flattened.—Brackish marshes and along the borders of cypress swamps, Florida. July–September.



FIG. 181. *Chloris neglecta* Nash in Bull. Torr. Bot. Club., 22: 423.—A rather stout perennial 6 to 12 dm. high, with compressed, glabrous culms and sheaths, flat leaves 10 to 35 cm. long, and four to six terminal spikes 8 to 12 cm. long. Closely allied to and much resembling *C. floridana*.—Low pine lands, Florida. October.



FIG. 182. *Chloris petraea* Sw.; Beal, Grasses N. Am., 2 : 408 (sub. *C. swartziana* Doell). SEASIDE FINGER-GRASS.—A creeping, glaucous perennial 3 to 6 dm. high, with obtuse, flat leaves and three to eight slender spikes 4 to 7 cm. long.—Southern Florida to southeastern Texas. [West Indies and Central and South America.] March–October.



FIG. 183. *Chloris floridana* (Chapm.) Vasey (*Eustachys floridana* Chapm.); Beal, Grasses N. Am., 2 : 407.—A smooth, rather slender perennial 3 to 6 dm. high, with compressed culms and sheaths, flat leaves and one or two spikes 6 to 8 cm. long. The spikes in this and in *C. neglecta* are stouter than in *C. petraea*.—Dry, sandy soil, Florida. July–October.

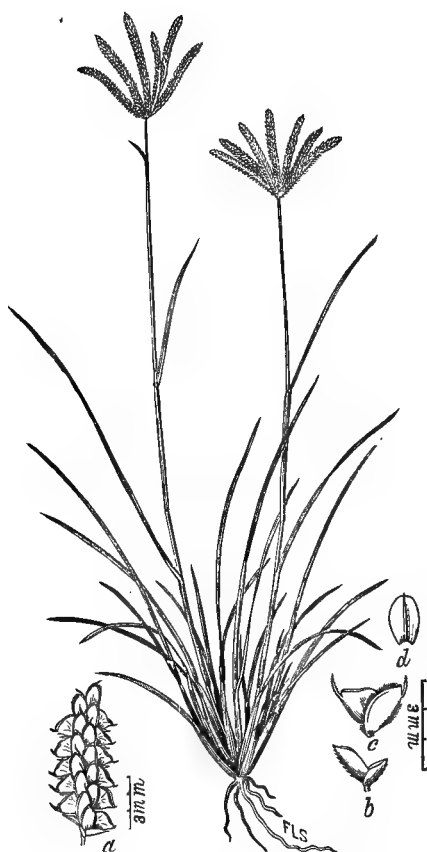


FIG. 184. *Chloris cucullata* Bisch.; Beal, Grasses N. Am., 2: 407.—A rather slender, caespitose perennial 2 to 4 dm. high, with narrow, flat leaves and eight to twelve spikes digitate or umbellate at the apex of the culms. Uppermost glumes cucullate.—Sandy plains, Texas to Arkansas. March–September.



FIG. 185. *Chloris verticillata* Nutt. WINDMILL-GRASS.—A low, spreading perennial, with rather stout, upright flowering branches 1.5 to 5 dm. high and numerous widely spreading, slender spikes 8 to 13 cm. long.—Prairies, Kansas to Texas. A good turf former. May–September.



FIG. 186. *Chloris elegans* HBK. (*C. alba* Presl); Beal, Grasses N. Am., 2: 403.—An erect perennial 3 to 6 dm. high, with slightly inflated sheaths, flat leaves and eight to twelve silky-bearded spikes, clustered or umbellate at the apex of the culms.—Dry mesas and desert hills of western Texas, southern Arizona, New Mexico, southern California and southward. An ornamental grass. June–November.



FIG. 187. *Chloris polydactyla* (L.) Sw. (*Andropogon polydactylon* L.). MANY-SPIKED CHLORIS.—A rather stout, leafy perennial about 6 dm. high, with numerous, more or less flexuose, brownish spikes 8 to 13 cm. long.—Florida. [West Indies and South America.]



FIG. 188. *Chloris texensis* Nash in Bull. Torr. Bot. Club, 23: 151.—A smooth, glaucous perennial 3 to 6 dm. high, the crowded lower sheaths compressed, with flat leaves and five to eight slender, terminal, digitate spikes 10 to 18 cm. long.—Texas. [Mexico?]]



FIG. 189. *Trichloris blanchardiana* Scribn. (*T. fasciculata* Fourn.).—A rather stout perennial 5 to 10 dm. high, with long, narrow leaves and many, slender, bearded spikes, which are fasciculate or subdigitate at the apex of the culm.—Dry plains and mesas, Texas to Arizona. May–September.



FIG. 190. *Trichloris pluriflora* Fourn. MANY-FLOWERED TRICHLORIS.—A glaucous, erect perennial 6 to 12 dm. high, with long, flat leaves and numerous erect, many-flowered, bearded spikes 8 to 15 cm. long. Spikelets three- to four-flowered.—Southern and western Texas. [Mexico.] May–July.



FIG. 191. *Gymnopogon ambiguus* (Michx.) B. S. P.; Britton and Brown, Ill. Fl., 1: 178 (*G. racemosus* Beauv.). NAKED BEARD-GRASS.—A loosely tufted, erect or ascending perennial 30 to 45 cm. high, with short and broad leaf blades and numerous (fifteen to thirty), slender and widely spreading spikes irregularly scattered along the common rachis.—Dry soil, fields, hillsides, and borders of woods, New Jersey to Missouri, Indian Territory, Texas, and Florida. July–October.

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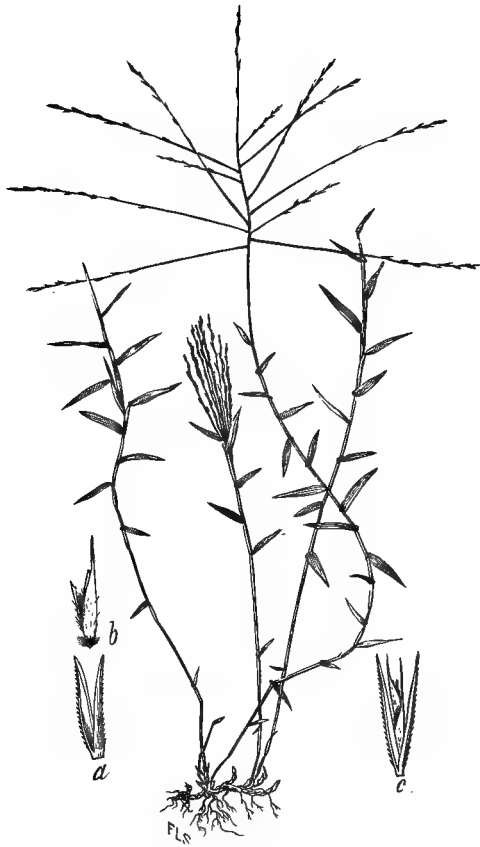


FIG. 192. *Gymnopogon brevifolius* Trin. SHORT-LEAFED BEARD-GRASS.—A slender, loosely tufted and many-jointed perennial, with erect or ascending culms 3 to 6 dm. high, short, flat leaves and numerous very slender spikes, which are naked toward the base.—Dry or moist pine barrens near the coast, New Jersey to Mississippi. August–November.

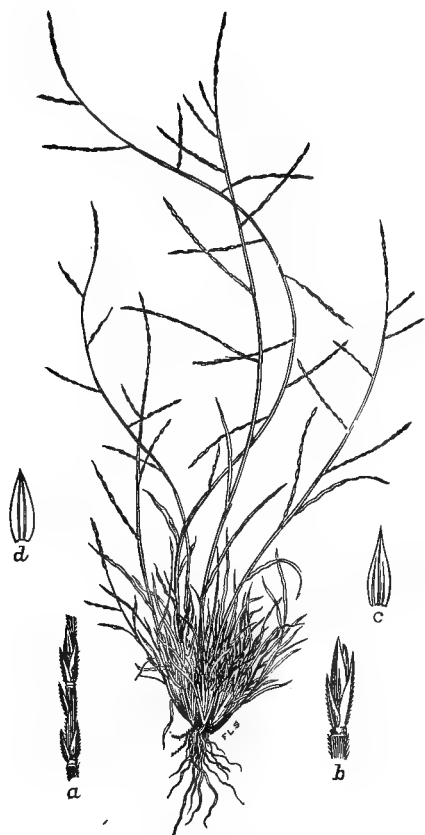


FIG. 193. *Schedonnardus paniculatus* (Nutt.) Trelease; Britton and Brown, Ill. Fl., 1: 179 (*S. texanus* Steud.). TEXAN CRABGRASS.—A low, diffusely branching annual, with short, narrow leaves and slender, paniculate spikes. The tufted stems vary from 1 to 9 dm. long.—Dry prairies, Illinois to Texas and New Mexico, north to Assiniboia and Manitoba. April–October.

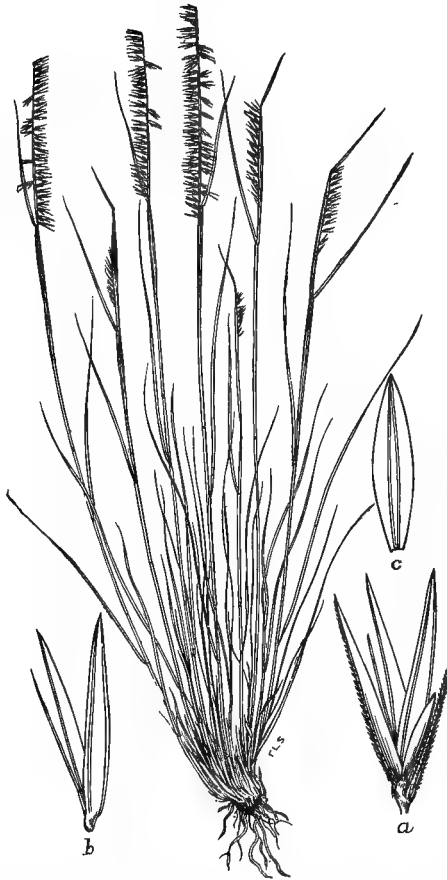


FIG. 194. *Bouteloua uniflora* Vasey; Beal, Grasses N. Am., 2: 426. ONE-FLOWERED GRAMA.—A slender, erect perennial 3 to 4.5 dm. high, with narrow, long-attenuate-pointed leaves and numerous (twenty-five to seventy-five), spreading or deflexed one-flowered spikes approximate along the common axis.—Southwestern Texas. September.



•FIG. 195. *Bouteloua curtipendula* (Michx.) Torr. (*B. racemosa* Lag.). TALL GRAMA or SIDE OATS.—A densely tufted perennial 3 to 9 dm. high, with numerous (twenty to sixty), usually spreading or reflexed spikes scattered along the common axis, forming a long, somewhat one-sided raceme 20 to 40 cm. long.—Dry fields, hillsides, and prairies, New York and Ontario to New Jersey, Mississippi, Texas, California, and Manitoba. [Mexico and Central and South America.] May–October.

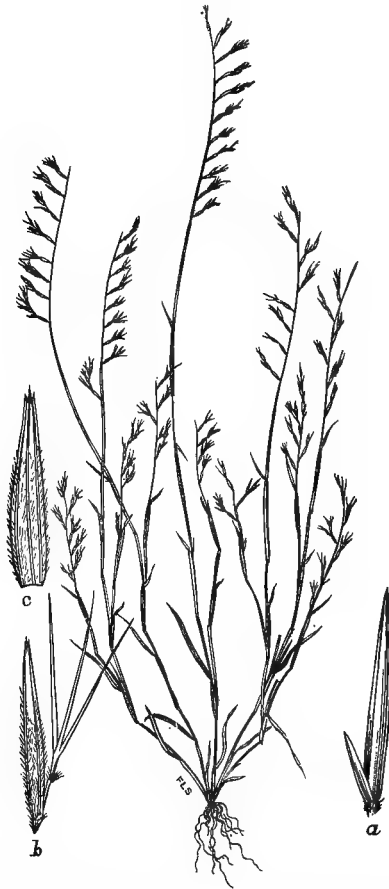


FIG. 196. *Bouteloua aristidoides* Thurb.; Beal, Grasses N. Am., 2: 425. SIX-WEEKS MESQUIT.—A slender, densely tufted and much branched annual (?) 1 to 3.5 dm. high, with short, narrow leaves, and three to twelve very narrow and few- (sometimes only one-) flowered spikes.—Texas to southern California. [Mexico and Lower California.] August, September.

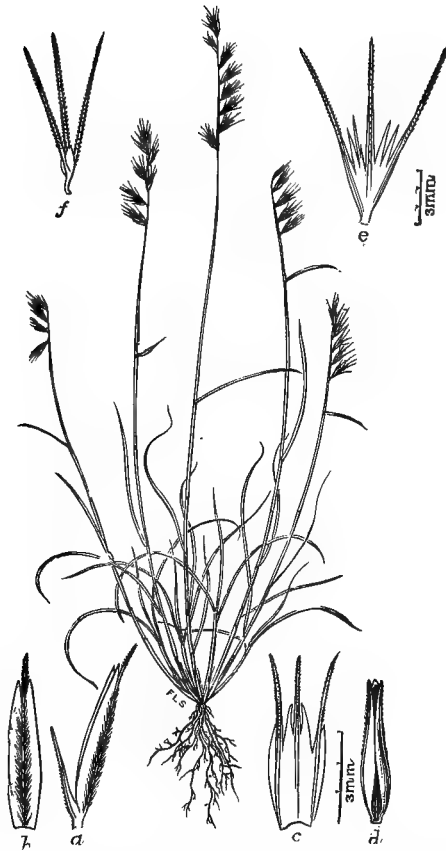


FIG. 197. *Bouteloua texana* S. Wats. ; Beal, Grasses N. Am., 2: 426. SEED MESQUITE.—A densely caespitose, usually glabrous perennial 2 to 3 dm. high, with narrow, flat leaves, and two to ten short, many-awned spikes, approximate on the common rachis.—Dry soil, Texas and Indian Territory to Arkansas. March, April.



FIG. 198. *Bouteloua havardi* Vasey; Beal, Grasses N. Am. 2: 424. HAVARD'S GRAMA.—A perennial, with strong rhizomes, upright culms 2 to 4 dm. high, and four to six short, silky-villous spikes approximate on the common rachis.—Sandy plains, rocky hills, canyons, about springs, etc., Texas to Arizona. [Northern Mexico.] April-September.



FIG. 199. *Bouteloua eriopoda* Torr.; Beal, Grasses N. Am., 2: 421. WOOLLY-JOINTED GRAMA.—A slender, branching, and somewhat wiry perennial with woolly-jointed stems 2 to 3.5 dm. long, with three to six slender, spreading, and rather loosely flowered spikes 1.5 to 2.5 cm. long.—Dry, gravelly soil, Texas to Arizona. [Northern Mexico.] August, September.



FIG. 200. *Bouteloua ramosa* Scribn.; Vasey, Grasses of the S. W., 1: 44. WIRY GRAMA.—An erect or ascending perennial, with branching and many-jointed culms 3 to 4.5 dm. high, short, narrow, spreading leaves, and one to three spreading and more or less arcuate spikes 1 to 3 cm. long.—In canyons, mountains of southwestern Texas. [Northern Mexico.] August, September.



FIG. 201. *Bouteloua breviseta* Vasey; Beal, Grasses N. Am., 2: 420. SHORT-AWNED GRAMA.—An erect, somewhat wiry and densely caespitose perennial 2.5 to 3.5 dm. high, the lower internodes covered with a thin white bloom. Leaves very narrow, 2 to 4 cm. long. Spikes one to three, erect or somewhat divergent, about 2 cm. long.—Southwestern Texas. September.



FIG. 202. *Bouteloua vestita* (S. Wats.) Scribn.; Beal, Grasses N. Am., 2: 419. HAIRY GRAMA.—A tufted annual, with erect or ascending slender culms 3 to 6 dm. high, with short, flat leaves and two to eight ascending, many-flowered, hairy spikes about 2 cm. long.—Sandy banks of streams and “benches” on mountain sides, western Texas to southern Arizona. [Mexico.] September, October.

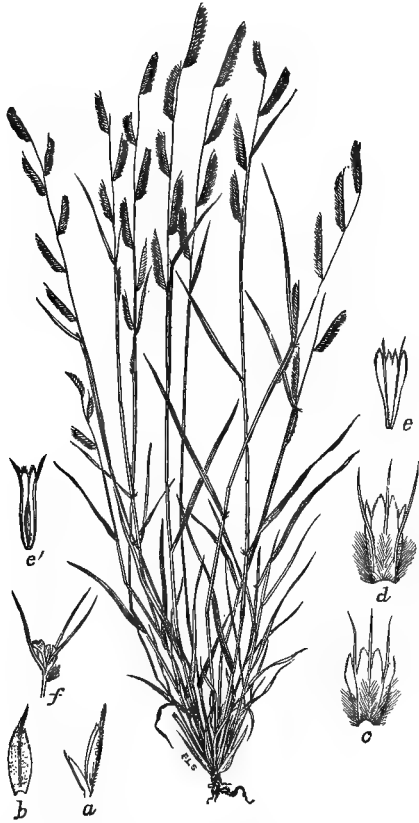


FIG. 203. *Bouteloua rothrockii* Vasey. ROTHROCK'S GRAMA.—
A densely caespitose perennial, with erect, simple or sparingly
branched leafy culms 1.5 to 2 dm. high, and five to nine more or less
spreading, densely flowered spikes 2 to 3 cm. long.—Sandy plains,
mesas and foothills, Arizona. [Mexico.] August, September.



FIG. 204. *Bouteloua oligostachya* (Nutt.) Torr. BLUE GRAMA.—A slender perennial 1.5 to 5 dm. high, with one to five remote, pectinately many-flowered, usually spreading spikes 2.5 to 5 cm. long.—Wisconsin to Montana, north to Manitoba and Alberta, south to Texas, Arizona, and southern California; also at Tampa, Fla. [Mexico.] June–October.

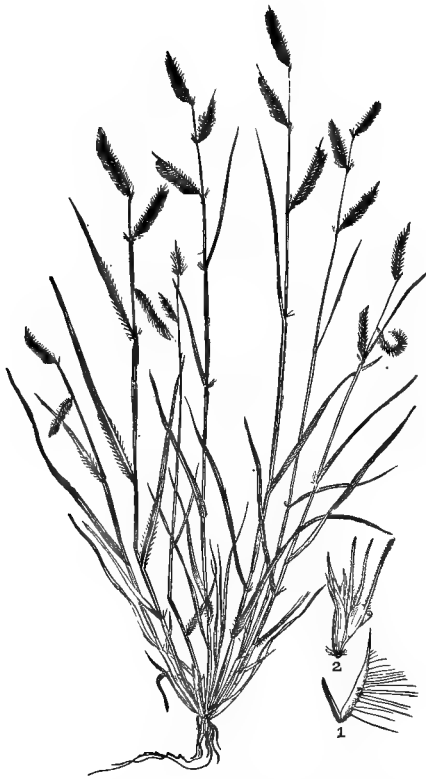


FIG. 205. *Bouteloua hirsuta* (HBK.) Lag. BRISTLY MESQUIT.—A caespitose perennial 1.5 to 4 dm. high, with erect or ascending culms, flat leaves, and one to three more or less spreading, densely flowered spikes 2 to 4 cm. long.—Dry prairies and sandy plains, Illinois and Wisconsin to South Dakota, Nevada, Arizona, and Texas, and (?) southern Florida. [Mexico and Lower California.] July–September.

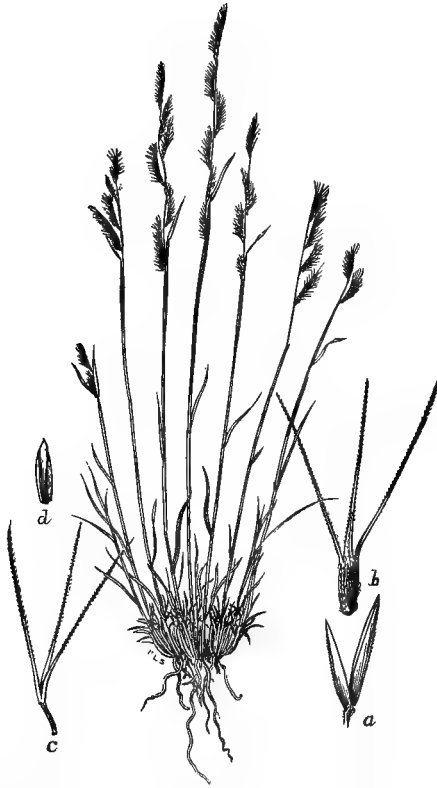


FIG. 206. *Bouteloua trifida* Thurb.; Beal, Grasses N. Am., 2 : 421. SMALL GRAMA.—A delicate perennial 1 to 3 dm. high, with short, narrow leaves, and three to seven ascending spikes usually about 2 cm. long.—Mesas and sandy plains, Texas to Arizona. [Northern Mexico.] May–October.



FIG. 207. *Bouteloua burkii* Scribn.; Beal, Grasses N. Am., 2 : 422. BURK'S GRAMA.—A slender, tufted perennial 15 (rarely 30) cm. high, with short, spreading leaves and slender, horizontal spikes 1 to 2 cm. long.—Sandy plains and dry mesas, western Texas. [Northern Mexico.] April-July.

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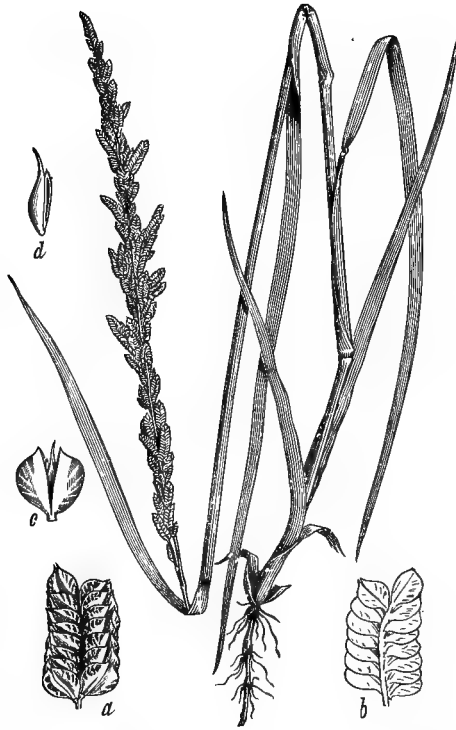


FIG. 208. *Beckmannia erucæformis* (L.) Host (*Phalaris erucæformis* Linn.). SLOUGH-GRASS.—A stout, erect, subaquatic perennial 3 to 12 dm. high, with narrow panicles composed of many, densely flowered one-sided spikes.—In sloughs and along the banks of rivers and streams, western Ontario to Iowa, California, British Columbia, and Alaska. [Europe and Asia.] June-September.



FIG. 209. *Eleusine indica* (L.) Gaertn. GOOSE or YARD-GRASS.—A coarse, tufted annual, with erect or spreading stems 1.5 to 6 dm. high, and two to five digitate spikes 5 to 7 cm. long.—Waste or cultivated ground, New Jersey to Ohio and Kansas, south to Florida and Texas. [Widely distributed in tropical and subtropical countries.] June–October.



FIG. 210. *Dactyloctenium aegyptium* (L.) Willd. (*Cynosurus aegyptius* L.; *Dactyloctenium aegyptiacum* Willd.). CROWFOOT-GRASS.—A low, tufted or creeping grass, with ascending flowering stems rarely 3 dm. high, and three to five digitate spikes 2 to 5 cm. long.—Waste or cultivated ground, southern New York to Illinois, south to Florida and Texas, west to California. [Widely distributed in tropical and subtropical regions of both hemispheres.] May–December.

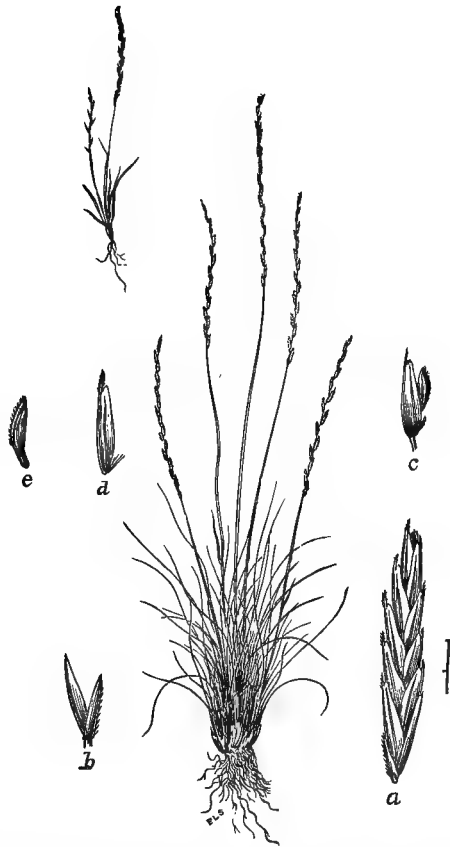


FIG. 211. *Leptochloa spicata* (Nees) Scribn. (*Bromus spicatus* Nees; *Diplachne spicata* Doell; *D. reverchoni* Vasey); Beal, Grasses N. Am., 2: 434.—A low, densely caespitose perennial (?), with numerous setaceous basal leaves and a slender, scape-like culm 6 to 15 cm. high.—Granitic rocks, central Texas. [Mexico and Brazil.] May–July.



FIG. 212. *Leptochloa fascicularis* (Lam.) A. Gray. CLUSTERED SALT-GRASS.—An erect, ascending or more or less diffusely spreading, caespitose, much-branched annual 5 to 6 dm. high, with numerous, erect, crowded spikes 6 to 8 cm. long.—Salt marshes along the coast, Rhode Island to Texas; saline soil in the interior, western New York to South Dakota, Nevada, New Mexico, and Texas. [Mexico and West Indies.] July–September.



FIG. 213. *Leptochloa viscida* (Scribn.) Beal (*Diplachne viscida* Scribn.). VISCID LEPTOCHLOA.—A densely caespitose and diffusely branched perennial (?) 0.5 to 3 (rarely 6) dm. high, with acute, flat leaves, and narrow, densely flowered panicles, composed of eight to twelve erect spikes.—Wet, clayey soil, New Mexico and Arizona. [Mexico and Lower California.] June–September.



FIG. 214. *Leptochloa imbricata* Thurb. (*Diplachne imbricata* Scribn.); Beal, Grasses N. Am., 2: 435.—A rather stout, erect or ascending perennial 3 to 9 dm. high, with smooth, usually glaucous culms, narrow, flat leaves, and numerous crowded, erect or ascending spikes 4 to 6 cm. long.—Texas to southern California. [Mexico and Lower California.] August–November.



FIG. 215. *Leptochloa scabra* Nees (*L. langloisii* Vasey).
ROUGH LEPTOCHLOA.—A stout annual 6 to 12 dm. high, with flat
leaves and very many, crowded, slender spikes in terminal panicles
3 dm. long.—Ditches and fields, Louisiana. [Brazil.] September.



FIG. 216. *Leptochloa nealleyi* Vasey (*L. stricta* Fourn.). NEALLEY'S LEPTOCHLOA.—A slender, or rather stout perennial, with erect or ascending culms 4.5 to 12 dm. high, and narrow, elongated panicles of many erect or ascending spikes.—Western Texas. [Mexico.] April-June.



FIG. 217. *Leptochloa dubia* (HBK.) Nees (*Chloris dubia* HBK.; *Diplachne dubia* Scribn.); Beal, Grasses N. Am., 2: 437.—A rather stout and apparently perennial species, 3 to 9 dm. high, with usually eight to ten approximate spreading spikes 6 to 8 cm. long.—Southern Florida, Texas to Arizona, and southward into Mexico. April–September.

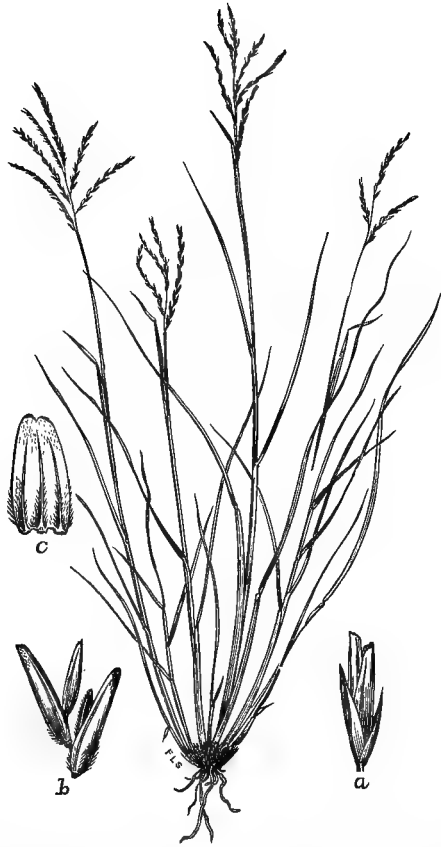


FIG. 218. *Leptochloa pringlei* (Vasey) Beal, Grasses N. Am., 2: 436.—A rather slender perennial 2.5 to 3.5 dm. high, with narrow leaves and four to six spikes 2.5 to 5 cm. long, approximate near the summit of the culm. Spikelets two- to three-flowered.—Arizona. April, May.

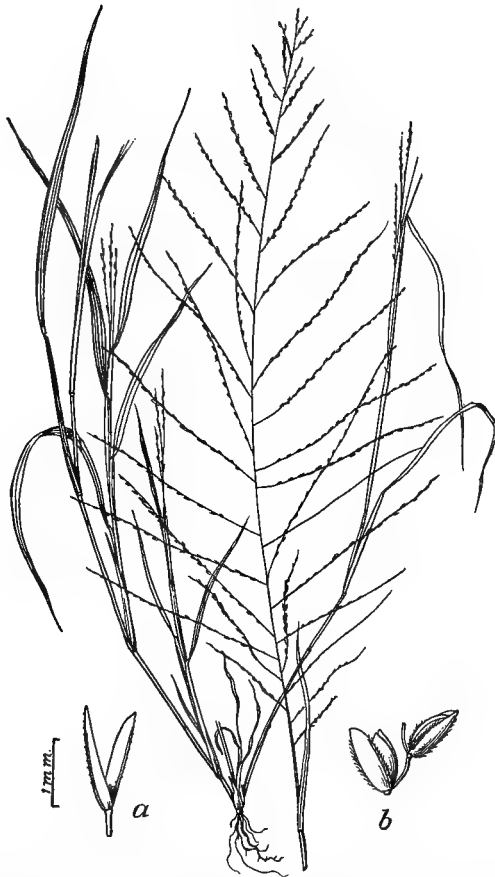


FIG. 219. *Leptochloa mucronata* (Michx.) Kunth. FEATHER-GRASS.—A more or less branching annual 6 to 12 dm. high, with rather broad, flat leaves and long terminal panicles of many slender spikes.—A weed in cultivated and waste grounds, Virginia, Illinois, Missouri, Tennessee, Alabama, Texas, Indian Territory, Arizona, and California. [Northern Mexico and Cuba.] June-October.

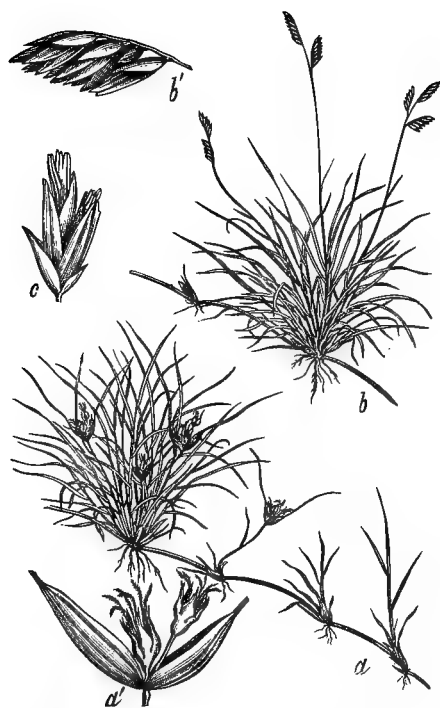


FIG. 220. *Bulbilis dactyloides* (Nutt.) Raf. (*Buchloë dactyloides* Engelm.); Britton and Brown, Ill. Fl., 1 : 183. BUFFALOGRASS.—A low, fine-leaved, and extensively creeping perennial, rarely more than 1 to 1.5 dm. high. Similar to Bermuda in habit of growth.—Dry prairies and river bottoms, Minnesota and South Dakota (ascends to 1,650 m. in Black Hills), to Arkansas, southern Texas, and Colorado. [Mexico.] March–August.



FIG. 221. *Pappophorum wrightii* S. Wats. (*P. boreale* Torr., not Griseb.); Beal, Grasses N. Am., 2: 448. PURPLE-GRASS.—A slender, branching and apparently annual species 2 to 4 dm. high, with narrow, involute leaves and densely flowered, spike-like, lead-colored or purplish panicles 1 to 7 cm. long.—Rocky hills, canyons, and open plains, western Texas to Arizona. [Northern Mexico.] July–September.



FIG. 222. *Pappophorum apertum* Scribn.; Bull. Torr. Bot. Club, 9: 148; Beal, Grasses N. Am., 2: 447.—A caespitose perennial 3 to 8 dm. high, with long, narrow, mostly involute leaves and narrow, pale, or often straw-colored panicles 15 to 20 cm. long.—Valleys, western Texas to Arizona and Mexico. June.



FIG. 223. *Cottea pappophoroides* Kth. COTTA-GRASS.—An erect, branching perennial 3 to 6 dm. high, with narrow, flat, pilose leaves and oblong, open panicles 9 to 18 cm. long; spikelets two- to six-flowered, floral glumes many-parted.—In canyons, western Texas to Arizona. [Mexico and South America.] August-October.

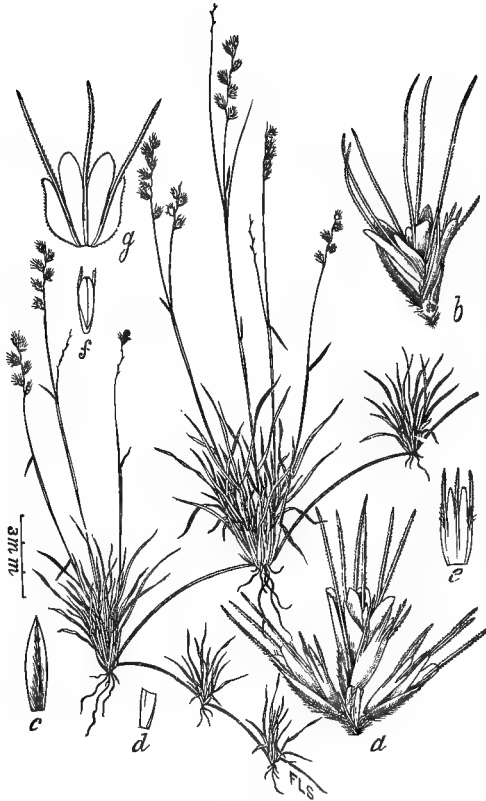


FIG. 224. *Cathestecum prostratum* Presl (*C. erectum* Vasey and Hack.); Beal, Grasses N. Am., 2 : 452.—An extensively creeping, slender perennial, with upright flowering branches 1 to 3 dm. high, narrow, flat leaves, and clustered spikelets in terminal or lateral racemes.—Dry mesas and bluffs along the Rio Grande, western Texas. [Mexico.] July–October.

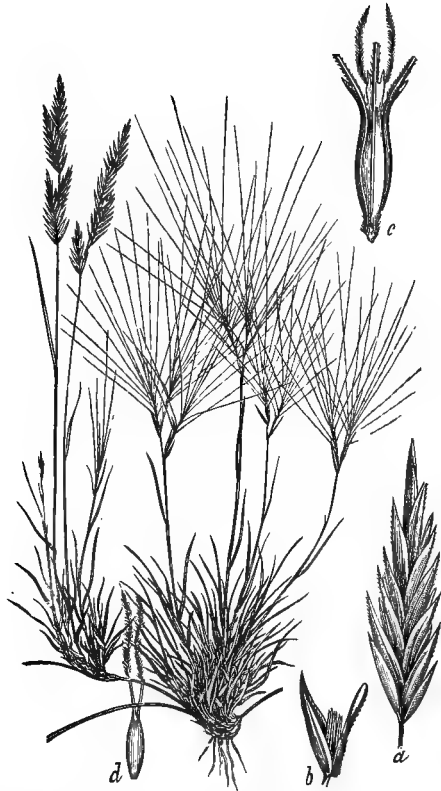


FIG. 225. *Scleropogon brevifolius* Philippi (*Tricuspis monstrosa* Munro; *Lesourdia multiflora* and *L. karwinskyana* Fourn.).—A wiry, creeping perennial with densely tufted, upright, leafy branches 1 to 2.5 cm. high, and unisexual spikelets: the pistillate long-awned, the staminate awnless.—Dry mesas and canyons, Colorado to Texas, New Mexico, Arizona, and southward into Mexico and South America. May–October.



FIG. 226. *Monanthochloe littoralis* Engelm. SALT CEDAR.—A creeping grass, with hard, woody stems, and crowded, subulate, rigid leaves 2 cm. long or less.—Rocky shores and salt marshes along the coast, southern Florida, extreme southern Texas, southern California. [Lower California.] May, June.



FIG. 227. *Munroa squarrosa* (Nutt.) Torr. FALSE BUFFALO-GRASS.—A low, diffusely much-branched annual, with crowded and sharply pointed, rigid leaves 0.5 to 2.5 cm. long.—Prairies and dry plains, South Dakota to Texas, west to Alberta, Montana, Colorado, and Arizona. June–October.



FIG. 228. *Orcuttia californica* Vasey; Beal, Grasses N. Am., 2: 457.—A low, much-branched, caespitose annual 0.5 to 1 dm. high, the numerous stems bearing three to six spikelets near the apex.—Southern and Lower California. April.



FIG. 229. *Phragmites vulgaris* (Lam.) B. S. P. (*P. communis* Trin.; *Arundovulgaris* Lam.; *A. phragmites* L.). COMMON REED.—A tall, stout, perennial grass, with stout, creeping rootstocks, numerous broad, attenuate-pointed leaves, and a large ovoid-pyramidal, purplish, terminal panicle.—Margins of lakes and rivers and in brackish coast marshes, almost everywhere in the United States and southern British America. [Widely distributed in temperate regions of both hemispheres.] August–October.



FIG. 230. *Triodia eragrostoides* Vasey & Scribn. (*Sieglinia eragrostoides* Dewey); Beal, Grasses N. Am., 2: 465.—Anerect, leafy perennial 6 to 9 dm. high, with long, narrow leaves and open, small-flowered panicles 2 to 3 dm. long.—Rocky banks, etc., southern Texas, southern Florida. [Northeastern Mexico.] June-October.



FIG. 231. *Triodia texana* S. Wats.; Beal, Grasses N. Am., 2 : 466.—A slender, wiry grass 3 to 6 dm. high, with very narrow leaves and loosely few-flowered, nodding panicles 10 to 15 cm. long.—Rich valley land, dry places, etc., Louisiana and Texas to Arizona. [Northern Mexico.] June–August.



FIG. 232. *Triodia ambigua* (Ell.) Vasey; Beal, Grasses N. Am., 2: 465, sub. *Sieglingia* (*Poa ambigua* Ell.).—An erect perennial 6 to 12 dm. high, with narrow, flat leaves and open, pyramidal panicles 10 to 20 cm. long.—Dry, open, pine barrens near the coast, South Carolina to Texas. July–October.



FIG. 233. *Triodia albescens* (Munro) Vasey (*Sieglingia albescens* Kuntze); Beal, Grasses N. Am., 2: 469. WHITE TOP.—A caespitose, erect perennial 4 to 7 dm. high, with narrow, flat leaves and densely flowered, spike-like panicles 9 to 15 cm. long.—Texas. August–October.



FIG. 234. *Triodia nealleyi* Vasey; Bull. Torr. Bot. Club., **15**: 49 (1888); (*Sieglingia nealleyi* Dewey; Beal, Grasses N. Am., **2**: 470).—A slender, glaucous, caespitose perennial, 3 to 4 dm. high, with flat or conduplicate leaves, and densely flowered, linear or ovoid panicles 4 to 5 cm. long.—Canyons and ridges, southwestern Texas. September.



FIG. 235. *Triodia acuminata* (Munro) Vasey (*Sieglingia acuminata* Kuntze); Beal, Grasses N. Am., 2: 470.—A slender, densely tufted perennial 1.5 to 2 dm. high, with short leaves, and simple, dense, oblong panicles 1.5 to 3 cm. long. — Poor, gravelly soil, hill-sides, etc., Texas to Arizona, north to Colorado and Indian Territory. [Northern Mexico.] April-June.

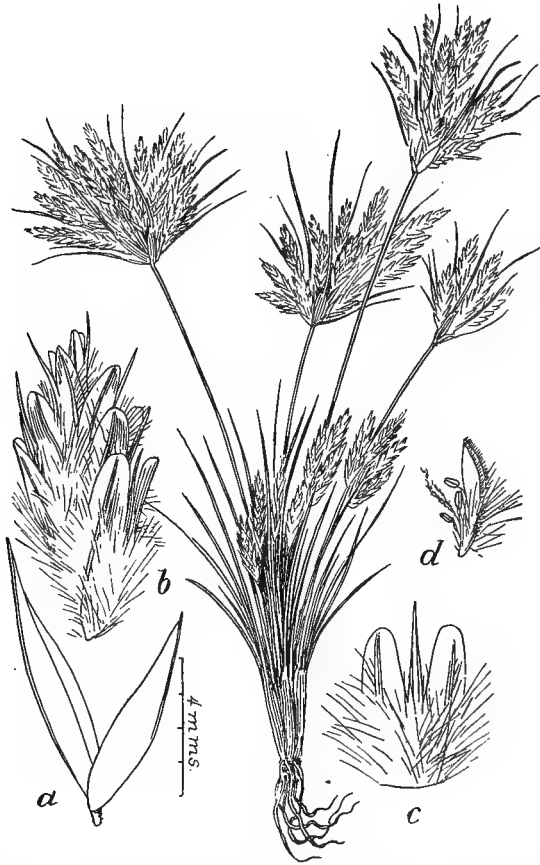


FIG. 236. *Triodia pulchella* HBK. (*Sieglingia pulchella* Kuntze); Beal, Grasses N. Am., 2: 468.—A low, densely tufted and often creeping perennial 2 to 15 cm. high, with very narrow leaves and crowded spikelets in clusters of three to six, which are equaled or exceeded by the upper leaves.—Western Texas to Nevada and southern California. [Northern Mexico.] February–June.



FIG. 237. **Triplasis americana** Beauv. (*Sieglingia americana* Beal, Grasses N. Am., 2: 466).—A slender, caespitose grass, with wiry culms 4 to 9 dm. high, rather short, narrow leaves, and few-flowered, simple panicles 3 to 10 cm. long; the pubescent awns 5 to 7 mm. long.—Dry, sandy soil near the coast, North Carolina to Mississippi. July–October.

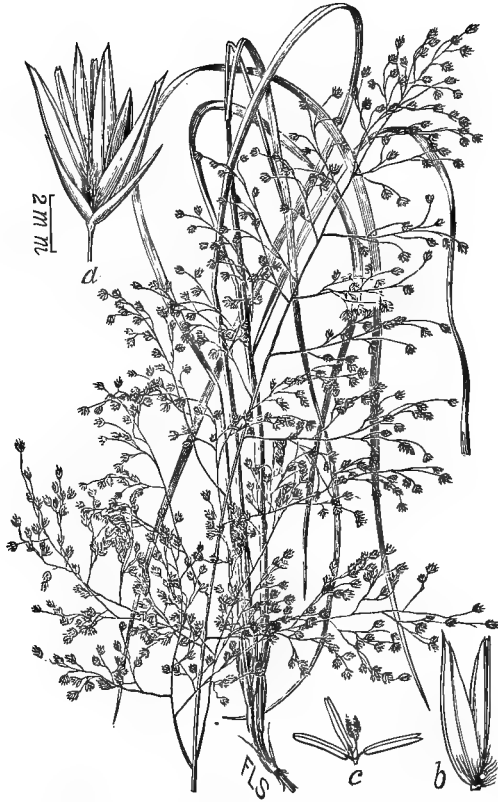


FIG. 238. *Redfieldia flexuosa* (Thurb.) Vasey (*Grapphephorum* (?) *flexuosum* Thurb.); Britton and Brown, Ill. Fl., 1: 186. RED-FIELD'S-GRASS.—A stout, native perennial 6 to 12 dm. high, with very long, narrow leaves and diffuse, capillary panicles 25 to 60 cm. long.—Sand hills and “blow-outs,” Kansas and Nebraska to Indian Territory, Colorado, and Wyoming. July, August.



FIG. 239. *Dissanthelium californicum* (Nutt.) Benth.; Beal, Grasses N. Am., 2: 473 (*Stenochloa californica* Nutt.).—A slender, glabrous, branching annual 1 to 3 dm. high, with short, narrow leaves and contracted, spike-like panicles 4 to 8 cm. long.—Santa Catalina Island, southern California, and Guadaloupe Islands, Lower California. September.

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FIG. 240. *Eragrostis neo-mexicana* Vasey; Beal, Grasses N. Am., 2: 485. CRAB-GRASS (in New Mexico).—A rather stout, branching and leafy annual 3 to 12 dm. high, with flat leaves and ample, diffuse panicles 20 to 40 cm. long.—Texas to southern California (ascends to 1,500 m. in Arizona). August. A valuable hay grass resembling Teff (*E. abyssinica*).



FIG. 241. *Eragrostis purshii* Schrad. SOUTHERN SPEAR-GRASS.—An annual, 1 to 4 dm. high, with the erect or ascending culms diffusely branching near the base, and diffuse panicles of small, spreading spikelets.—Sandy river banks, waste ground, etc., Massachusetts and Ontario to South Dakota and California, south to Florida, Texas, and Arizona. [Mexico.] June–October.



FIG. 242. *Eragrostis curtipedicellata* Buckl.; Britton and Brown, Ill. Fl., 1: 190. SHORT-STALKED ERAGROSTIS.—A rather rigid, branching perennial 3 to 9 dm. high, with flat, spreading leaves and diffuse panicles 20 to 30 cm. long. Related to *E. pectinacea*.—Prairies, Kansas, Indian Territory, and Texas. July–September.



FIG. 243. *Eragrostis pectinacea* (Michx.) Steud.—An erect, caespitose perennial 3 to 9 dm. high, with a short, stout rootstock and large, spreading, red-purple panicles.—Dry, sandy soil in the open, Massachusetts to South Dakota and Colorado, south to Florida and Texas. July–October.



FIG. 244. *Eragrostis brownei* Nees (?).—A widely spreading, branching perennial, with somewhat wiry culms 2 to 5 dm. long, and narrow, simple, more or less interrupted panicles of nearly sessile, ten- to forty-flowered spikelets.—Dooryards and waste ground, Florida. [Widely distributed in tropical and subtropical regions.] July–October.



FIG. 245. *Eragrostis hypnoides* (Lam.) B. S. P. (*Poa hypnoides* Lam.; *E. reptans* Nees).—A prostrate, much-branched, and extensively creeping annual, with ascending, flowering branches 7.5 to 15 cm. high, spreading leaf blades, narrow and lax or very dense panicles and long, linear-lanceolate, strongly compressed spikelets.—In ditches and sandy banks of streams, Vermont and Ontario to Florida, Texas, California, and Washington. [Mexico, West Indies, and South America.] March–October.



FIG. 246. *Eragrostis glomerata* (Walt.) L. H. Dewey (*Poa glomerata* Walt.; *P. conferta* Ell.; *Eragrostis conferta* Trin.).—An erect, rather stout, branching annual 6 to 9 dm. high, with smooth sheaths and leaves, and elongated, densely flowered, light-colored panicles 25 to 60 cm. long.—Low grounds, South Carolina to Florida and westward to Texas. [Cuba, Mexico, and South America.] August–November.



FIG. 248. *Eragrostis ciliaris* (L.) Link (*Poa ciliaris* L.).—A diffusely branching, slender annual 2 to 5 dm. high, with thin, narrow leaves and densely flowered, cylindrical, spike-like, more or less interrupted panicles 5 to 10 cm. long.—Cultivated and waste ground, Georgia and Florida to Mississippi. [Mexico, West Indies, and Asia.] July–October.

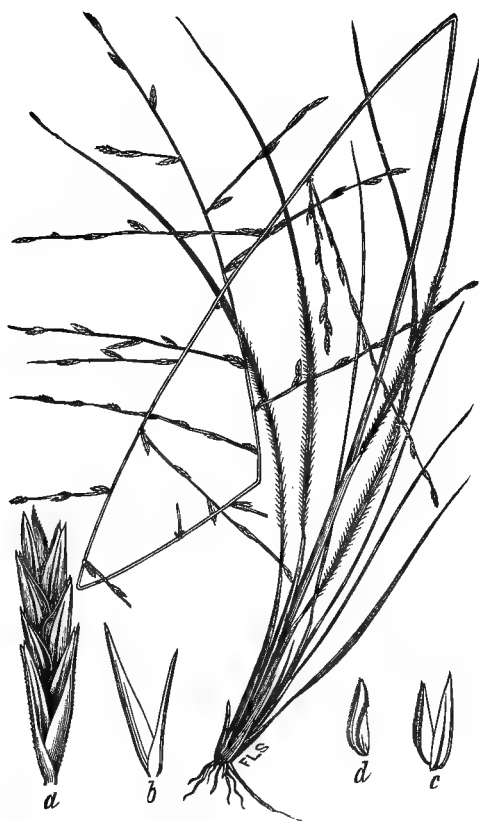


FIG. 250. *Eragrostis sessilispica* Buckl.; Britton and Brown, Ill. Fl., 1: 190 (*Diplachne rigida* Vasey).—A smooth, wiry, caespitose perennial 3 to 9 dm. high, with narrow, mostly involute leaves and pyramidal panicles, the five- to twelve-flowered, appressed spikelets sessile along the spreading branches.—Dry prairies, Kansas to Texas. June–October.



FIG. 251. *Eatonia pennsylvanica* (DC.) A. Gray. EATON'S GRASS.—A slender, pale-green perennial, with flat leaf blades and narrow terminal panicles.—Wet meadows, low woods, and thickets, Newfoundland and Maine to British Columbia and Washington, south to Georgia, Mississippi, Texas, and Arizona. April-August.



FIG. 252. *Eatonia obtusata* (Michx.) A. Gray. EARLY BUNCH-GRASS.—A tufted perennial 4.5 to 6 dm. high, with flat leaf blades and rather densely flowered, nodding panicles.—Low ground, chiefly along streams, usually in shade, Massachusetts and Ontario to Assiniboia and British Columbia, south to Florida, Texas, and southern California. March–August.



FIG. 253. *Eatonia nitida* (Sprengel) Nash (*Aira nitida* Spr.; *Eatonia dudleyi* Vasey).—A slender, erect, and caespitose perennial 3 to 6 dm. high, with short, flat, spreading leaves and rather few-flowered, nodding panicles.—Dry, open woodlands, Rhode Island and New York westward to North Dakota, and southward to North Carolina, Mississippi and Texas. April–June.



FIG. 254. *Eatonia filiformis* (Chapm.) Vasey; Beal, Grasses, N. Am., 2 : 491.—An erect, tufted perennial 3 to 6 dm. high, with very long upper internodes and long, involute, radical leaves.—Dry, sandy soil, South Carolina, Florida and Texas, north to western Tennessee. March, April.



FIG. 255. *Cynosurus cristatus* L. DOG'S-TAIL-GRASS.—A slender, erect perennial 3 to 7½ dm. high, with narrow leaves and rather slender, erect, spike-like panicles.—Sparingly established in fields and waysides, Newfoundland to Ontario, south to New Jersey; Portland, Oregon. [Europe.] June-August.
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FIG. 256. *Catabrosa aquatica* (L.) Beauv.; Britton and Brown, Ill. Fl., 1: 194. WATER WHORL-GRASS.—A smooth, soft perennial, with creeping or ascending culms 2 to 6 dm. long, flat leaves and open panicles 5 to 20 cm. long, the spreading branches in whorls.—In swales and along brooks, often in shallow water, Newfoundland and Labrador, to Quebec and Alaska, south to Nebraska, Colorado, and Utah. [Europe and Asia.] June–August.



FIG. 257. *Melica mutica* Walt. (*M. glabra* Mx.).—A slender, loosely caespitose, wiry grass 6 to 9 dm. high, with flat leaves and simple or racemose panicles of rather large, nodding, two- to three-flowered spikelets.—Dry, rocky, open woods and thickets, Pennsylvania to Florida and westward to Wisconsin and Texas. March-May.



FIG. 258. *Melica parviflora* (Porter) Scribn. (*M. mutica parviflora* Porter; *M. porteri*, Scribn.).—A rather slender, erect, smooth perennial 4 to 7 dm. high, with flat leaves and narrow panicles 15 to 25 cm. long. Spikelets pendulous and racemose along the panicle branches.—Shaded canyons, mountains of Colorado, New Mexico, Arizona and prairies of Missouri, Kansas, and western Texas. [Northern Mexico.] July–September.



FIG. 259. *Melica spectabilis* Scribn.; Beal, Grasses N. Am., 2: 506.—A caespitose, stoloniferous species 3 to 6 dm. high, with scabrous, flat leaves, and loosely flowered, nodding, simple panicles 10 to 20 cm. long.—Damp grassy meadows, rich bottom lands, dry hillsides, etc. (alt. 950 to 2,400 m.), Montana to Washington and Oregon, south to Colorado, Wyoming, and Nevada. June-September.



FIG. 260. *Melica stricta* Boland. Beak, Grasses N. Am., 2: 503.
 LARGE-FLOWERED MELICA.—A densely caespitose perennial 2 to 5 dm. high from a bulbous base, with flat, more or less pubescent leaves, and simple, one-sided panicles 10 to 15 cm. long, bearing ten to twenty spikelets.—Dry ridges among rocks (alt. 1,850 to 2,700 m.), Nevada, California, and Oregon. June–August.



FIG. 261. *Melica bulbosa* Geyer; Beal, Grasses N. Am. 2 : 508. THICK-ROOTED BUNCH-GRASS.—A slender, erect perennial 3 to 6 or rarely 9 dm. high, bulbous at the base, with erect leaves and a narrow, somewhat spike-like panicle 10 to 15 cm. long.—Dry rockyslopes, moist shady mountain sides, etc. (alt. 900 to 2,700 m.), Montana and Wyoming to British Columbia, south to Utah, Nevada, and Oregon; western Texas. May–July.



FIG. 262. *Korycarpus diandrus* (Michx.) Kuntze; Britton and Brown, Ill. Fl., 1: 196; (*Diarrhena americana* Beauv.).—An erect perennial 6 to 9 dm. high, with long, narrow-lanceolate, nearly erect leaves and a few-flowered, simple panicle 10 to 25 cm. long.—Rich, rocky, wooded hillsides, Ohio to South Dakota, south to Georgia, Arkansas, and Indian Territory. August, September.



FIG. 263. *Pleuropogon refractum* (A. Gray) Benth. (*Lophochlæna refracta* A. Gray); Beal, Grasses N. Am., 2: 514. NODDING PLEUROPOGON.—A slender perennial 6 to 12 dm. high from creeping rootstocks, with flat leaves and terminal racemes of six to ten drooping spikelets 2 to 3 cm. long.—In swamps and along mountain streams (alt. 1,200 to 3,850 m.), California to Washington. May–August.



FIG. 264. *Uniola latifolia* Michx. BROAD-LEAFED SPIKE-GRASS.—An erect grass, with rather stout, simple culms 6 to 12 dm. high, broad, spreading leaf blades and a drooping panicle of large, flat spikelets 2 to 3 cm. long.—Low thickets and shaded banks of streams, Pennsylvania to Florida, west to Illinois, Kansas, and Texas. June–October.



FIG. 265. *Uniola paniculata* L. ; Beal, Grasses N. Am., 2: 516. SEASIDE OATS.—A stout, native perennial 9 to 15 dm. high, with long, rigid leaves and showy, nodding panicles of many broad and pale straw-colored spikelets.—Drifting sand of sea beaches, Virginia to Texas. [West Indies and South America.] May–October.



FIG. 266. *Uniola laxa* (L.) B. S. P. ; Britton and Brown, *Ill. Fl.*, 1: 197 (*U. gracilis* Michx.).—A slender grass 6 to 9 dm. high, with long, narrow leaf-blades, and a contracted, wand-like, nodding panicle 15 to 45 cm. long.—In dry soil, open woods, and banks, Long Island to Florida, west to Kentucky, Tennessee, and Texas. June–October.

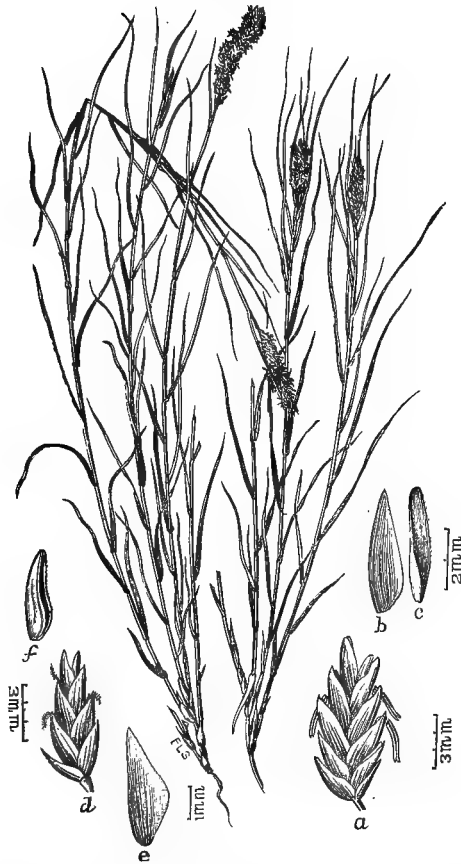


FIG. 267. *Distichlis spicata* (L.) Greene; Britton and Brown, Ill. Fl., 1: 198 (*D. maritima* Raf.). ALKALI-GRASS.—An upright, wiry grass, 2.5 to 5 dm. high, with strong and widely creeping rootstocks, rather rigid leaves, and densely flowered panicles. The grass is dioecious.—Salt marshes along the coast, Maine to Texas and British Columbia to California; alkaline soil in the interior, Nebraska and Kansas to Montana, eastern Washington, California, and New Mexico. May-August.



FIG. 268. *Briza media* L. QUAKING-GRASS.—A slender, erect perennial, with rather short, flat leaf-blades and capillary, spreading panicles.—Sparingly naturalized in fields and waste ground, in Ontario, New England, and California. [Europe and Asia.] May-July.

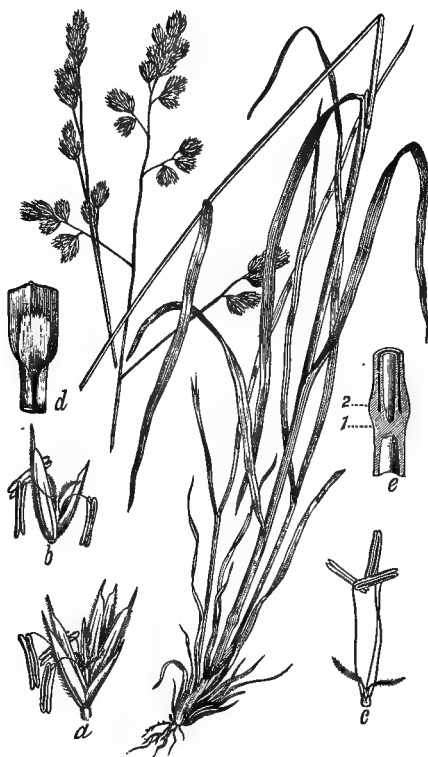


FIG. 269. *Dactylis glomerata* L. ORCHARD-GRASS.—A coarse, erect grass 9 to 12 dm. high, forming dense tufts, with long, flat leaf blades, and spikelets crowded in dense, one-sided clusters at the ends of the panicle branches.—Extensively naturalized in fields and waste ground, New Brunswick to South Carolina, west to Manitoba, Idaho, and Colorado. [Europe.] May–August.



FIG. 270. *Lamarckia aurea* (L.) Moench. GOLDEN-TOP.—A caespitose, branching annual 1 to 3 dm. high, with elegant one-sided panicles 5 to 8 cm. long.—Introduced into southern and Lower California. [Southern Europe, northern Africa, and Australia.] March-May.



FIG. 271. *Poa chapmaniana* Scribn.—A low, caespitose annual 1 to 2 dm. high, with ascending, flat leaves and usually narrow panicles 2 to 8 cm. long. Allied to *P. annua*, but more strict in habit of growth.—Dry sandy soil, southern Illinois to Mississippi and Georgia. April, May.

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FIG. 272. *Poa alpina* L. MOUNTAIN SPEAR-GRASS.—A slender or stout, caespitose, erect perennial 0.5 to 3 (usually 1.5) dm. high, with rather broad, flat leaves, and spreading pyramidal panicles of comparatively large spikelets.—Edges of brooks, open grassy mountain slopes, canyons, etc., Newfoundland and Quebec to Hudson Bay and Alaska, south in the mountains to Colorado (alt. 3,600 m.), Utah and California. [Widely distributed, arctic and subalpine.] June–August.



FIG. 273. *Poa pratensis* L. KENTUCKY BLUE-GRASS.—A slender, erect, stoloniferous perennial 3 to 9 dm. high, with narrow, flat leaves and more or less spreading, usually pyramidal panicles.—Fields and meadows throughout the United States and British America, abundantly naturalized in the East, indigenous in the North and West. [Europe and Asia.] Summer. A valuable pasture grass.



FIG. 274. *Poa kelloggii* Vasey; Ill. N. Am. Grasses, 2: 79. KELLOGG'S SPEAR-GRASS.—A slender, erect or ascending perennial 4 to 6 dm. high, with rather long, flat leaves and open pyramidal panicles 7 to 10 cm. long. Spikelets two- to four-flowered.—California (4705 Bolander).



FIG. 275. *Poa sylvestris* A. Gray. WOODLAND SPEAR-GRASS.—A slender, tufted perennial 3 to 9 dm. high, with an open panicle 10 to 15 cm. long, the branches spreading or reflexed.—Rich woods and thickets, New York to Wisconsin and Nebraska, south to North Carolina, Louisiana and Texas. April-July.



FIG. 276. *Poa brevifolia* Muhl. SOUTHERN SPEAR-GRASS.—An erect perennial 3 to 6 dm. high, with running rootstocks, short culm leaves, and a widely spreading, few-flowered panicle.—Wooded river bluffs and the grassy summits and wooded slopes of mountains, New Jersey to northern Ohio and Illinois, south to North Carolina and Tennessee. March-May.



FIG. 277. *Poa arida* Vasey; Britton and Brown, Ill. Fl., 1: 208.
 PRAIRIE SPEAR-GRASS.—An erect, often rather rigid, stoloniferous perennial 3 to 6 dm. high, with flat or folded, stiff leaves and narrow, rather densely flowered panicles 8 to 15 cm. long.—Meadows and low grounds, Northwest Territory to Kansas and Arizona. April–August.

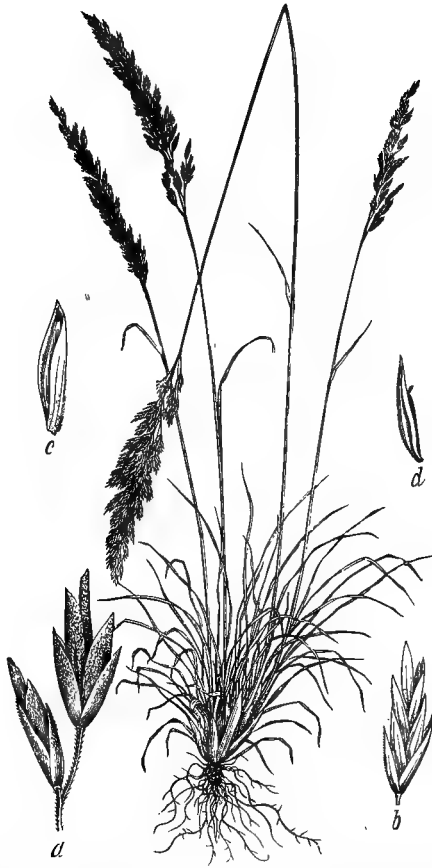


FIG. 278. *Poa buckleyana* Nash; Britton and Brown, Ill. Fl., 1: 208 (*Poa tenuifolia* Buckley). BUNCH RED-TOP.—A rather slender, erect perennial “bunch grass” 3 to 6 dm. high, with numerous, soft radical leaves and a narrow panicle.—Usually in dry soil of “bench” lands, mountain slopes, elevated prairies, etc. (alt. 450 to 3,900 m.), South Dakota to British Columbia, Colorado, and California. May–September.



FIG. 279. *Graphephorum melicoideum* (Michx.) Beauv.—A rather slender, erect, pale-green, caespitose perennial 3 to 6 dm. high, with flat leaves and loosely flowered, nodding panicles 7 to 14 cm. long.—Rocky or gravelly river shores, low woods (sometimes pine woods), etc., Anticosti Island to Vermont, Michigan, and Northwest Territory. August, September. (Allied to *Trisetum*.)



FIG. 280. *Panicularia aquatica* (Sm.) Kuntze (*Glyceria aquatica* J. E. Smith). REED MEADOW-GRASS.—A stout perennial 9 to 15 dm. high, with rather broad, flat leaf blades and an ample open panicle.—Shaded banks of streams, wet meadows, moist thickets, etc., New Brunswick to Alaska, south to Pennsylvania, Tennessee, Nebraska, New Mexico, and southern California. June–August.



FIG. 281. *Panicularia nervata* (Willd.) Kuntze (*Glyceria nervata* Trin.). FOWL MEADOW-GRASS.—A leafy perennial 3 to 9 dm. high, with an expanded, nodding panicle, and rather small spikelets.—Wet meadows, marshes, moist thickets, etc., Newfoundland to Florida, west to British Columbia, California, and Arizona. June–September.



FIG. 282. *Panicularia elongata* (Torr.) Kuntze (*Glyceria elongata* Trin.) (*Poa elongata* Torr.).—An erect perennial 6 to 9 dm. high, with flat leaf blades and narrow, rather densely flowered panicles.—In rich, wet woods, Newfoundland and New Brunswick to North Carolina, west to Quebec, Minnesota, and Kentucky. July–September.



FIG. 283. *Panicularia pallida* (Torr.) Kuntze (*Glyceria pallida* Trin. *Windsoria pallida* Torr.). PALE MANNA-GRASS.—A perennial, with slender stems 3 to 9 dm. long, ascending from a more or less decumbent base, and a lax, few-flowered panicle with ascending branches.—Bogs, banks of streams and ponds, Cape Breton to Ontario, south to Virginia, eastern Tennessee and Indiana. June–August.



FIG. 284. *Panicularia canadensis* (Michx.) Kuntze; Britton and Brown, Ill. Fl., 1: 211 (*Glyceria canadensis* Trin.). RATTLE-SNAKE-GRASS.—A stout, native perennial 6 to 9 dm. high, with flat leaves, and ample, nodding panicles of rather large spikelets.—Marshes and ditches, Newfoundland and Nova Scotia to Minnesota, south to New Jersey, Ohio, and Kansas. June–August.



FIG. 285. *Panicularia fluitans* (L.) Kuntze (*Glyceria fluitans* R. Br.). FLOATING MANNA-GRASS.—An erect grass 9 to 15 dm. high with somewhat flattened culms, long leaves, and a narrow panicle about 3 dm. long.—Wet places, often in running water, Newfoundland to Alaska, south to North Carolina, Tennessee, Texas, and California. [Widely distributed in temperate regions.] May–September.

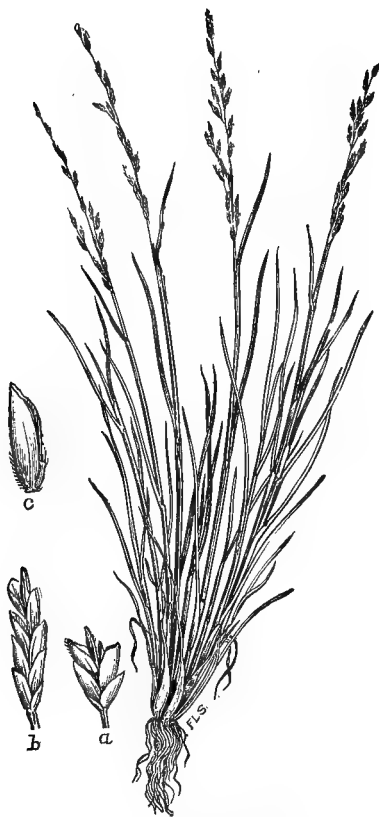


FIG. 286. *Puccinellia maritima* (Huds.) Parl. (*Poa maritima* Huds.; *Glyceria maritima* M. & K.). SEA SPEAR-GRASS.—A slender perennial 2 to 5 dm. high, from creeping rootstocks, with narrow, flat, or folded leaves, and more or less expanded panicles 8 to 12 cm. long.—Salt marshes and beaches along the coast, Labrador to southern New England, and Alaska to British Columbia; also on ballast and waste ground in sea ports farther south. [Europe and Asia.] July, August.



FIG. 287. *Festuca elatior arundinacea* (Schreb.) Hack. REED FESCUE.—A stout, leafy perennial 9 to 12 dm. high, with broad, flat leaves, and ample, elongated panicles often 3 dm. long.—Introduced here and there, District of Columbia, Michigan, Utah, Oregon, etc. [Europe.] August.
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FIG. 288. *Festuca elatior pratensis* (Huds.) Hack. MEADOW FESCUE.—An upright perennial 6 to 9 dm. high, with numerous flat leaves and a rather narrow panicle 10 to 20 cm. long.—In fields and waysides, introduced, Nova Scotia to North Carolina, west to Washington, Oregon, and Kansas. June-August.



FIG. 289. *Festuca rubra glaucescens* Hack.; Beal, Grasses N. Am., 2 : 606. TENNESSEE FESCUE.—A slender perennial 3 to 6 dm. high, with creeping rootstocks, erect or ascending stems, very narrow, usually glaucous leaves, and lax, nodding panicles. Forms a dense turf.—Bluffs of Cumberland River, Nashville, Tenn. May.

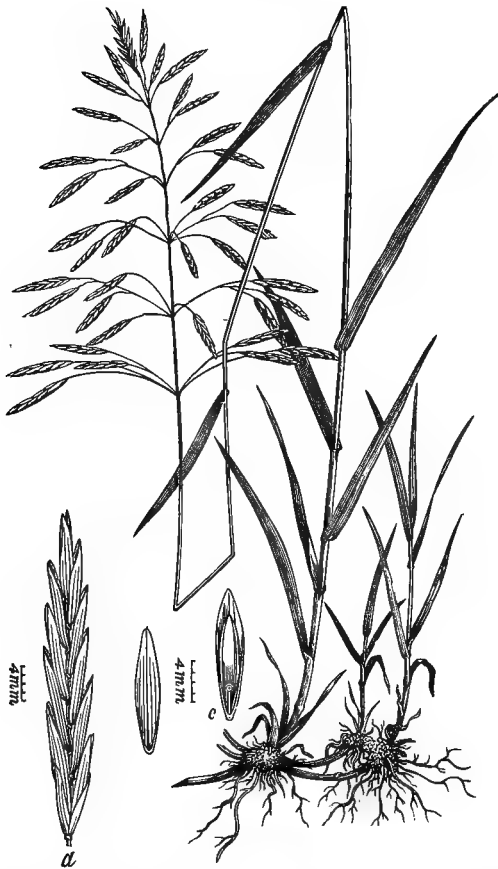


FIG. 290. *Bromus inermis* Leyss. SMOOTH BROME or HUNGARIAN BROME-GRASS.—An erect perennial 6 to 15 dm. high, with creeping rootstocks, open panicles 12 to 18 cm. long, and five- to nine flowered, awnless spikelets 2 to 3 cm. long.—A native of Europe, introduced and cultivated in many parts of the United States for hay. June, July.



FIG. 291. *Bromus secalinus* L. CHESS or CHEAT.—An erect annual 6 to 9 dm. high, with flat leaves, more or less expanded panicles, and turgid, short-awned spikelets, which are pendulous in fruit.—Naturalized in cultivated and waste grounds, especially in grain fields. [Europe and Asia.] June–August.



FIG. 292. *Bromus brizaeformis* Fisch. & Mey. BRIZA-LIKE BROME-GRASS.—A slender, erect, caespitose annual 2 to 5 dm. high, with soft, flat leaves and nodding panicles of large ten- to fifteen-flowered spikelets 2 to 3 cm. long.—Meadows and cultivated fields, introduced, Montana to Washington, south to Utah, Nevada, and California; sparingly in Massachusetts, New York, and Pennsylvania. [Europe and Asia.] June–August.



FIG. 293. *Bromus unioloides* (Willd.) HBK. RESCUE-GRASS.—An erect, usually annual grass, 3 to 9 dm. high, with more or less pubescent, flat leaf blades, and usually nodding, loose panicles of rather large, strongly flattened spikelets.—Prairies and dry, sandy fields, Indian Territory and Texas to Arizona; naturalized in Alabama. [Mexico and South America.] March–July.

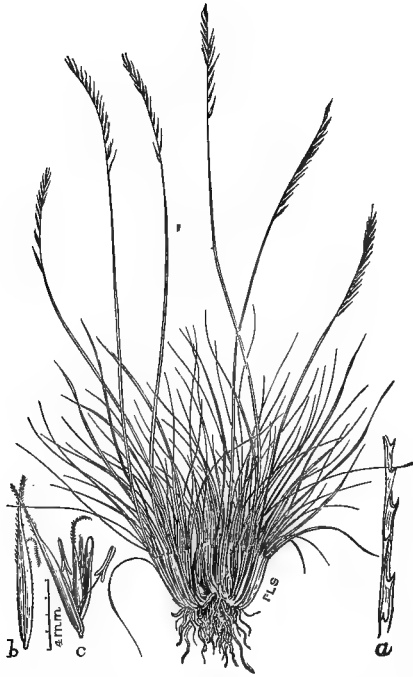


FIG. 294. *Nardus stricta* L.; Britton and Brown, Ill. Fl., 1: 224. WIRE BENT.—A glabrous, densely caespitose perennial, with stout, creeping rootstocks, setaceous leaves, and erect, filiform, rigid culms, 10 to 20 cm. high.—Introduced at Amherst, Mass.; rocky river banks, Newfoundland. [Europe, Greenland and Azores.] August.



FIG. 295. *Lolium perenne* L. RYE-GRASS.—A smooth, leafy perennial 3 to 9 dm. high, with slender, terminal spikes 7.5 to 25 cm. long.—Lawns, fields, and waysides, naturalized, Canada to North Carolina, west to Ohio and Tennessee; California and Arizona. [Europe and Asia.] May–August.

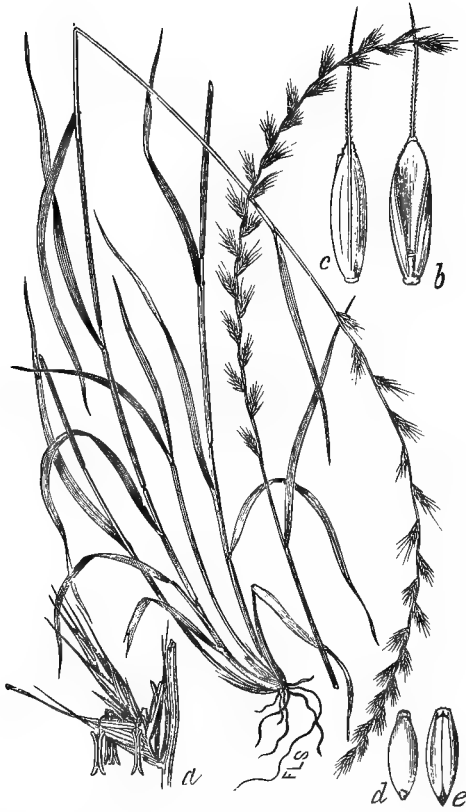


FIG. 296. *Lolium italicum* A. Br. ITALIAN RYE-GRASS.—A biennial or perennial grass 6 to 9 dm. high, with slender, usually somewhat nodding, terminal spikes, and short-awned spikelets. A valuable hay grass.—Introduced here and there through cultivation, especially on the Pacific Slope.

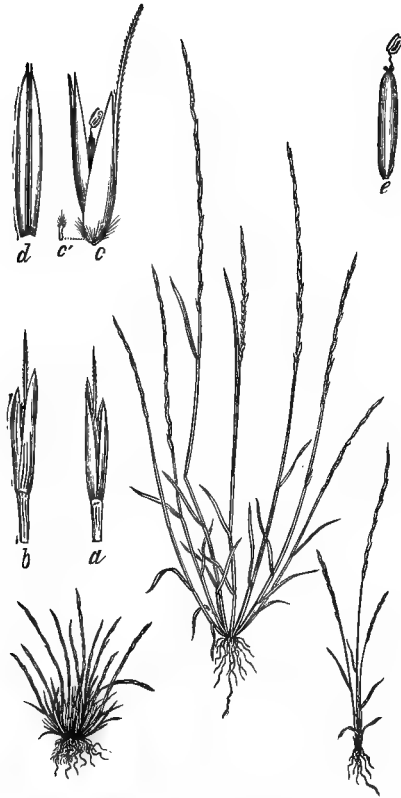


FIG. 297. *Scribneria bolanderi* (Thurb.) Hack. (*Lepturus bolanderi* Thurb.). Beal, Grasses N. Am., 2 : 634.—A slender, wiry, caespitose annual 1 to 2 dm. high, with short, narrow leaves and terminal, slightly compressed spikes.—Sterile grounds, hillsides, and roadsides, Washington to California. May.



FIG. 298. *Agropyron repens* (L.) Beauv. (*Triticum repens* L.).
 COUCH-GRASS.—An erect, stoloniferous perennial 3 to 12 dm. high,
 with flat leaves, which are pilose along the nerves above, and
 terminal, densely flowered spikes.—Naturalized in lawns, way-
 sides, and cultivated ground, Newfoundland and Cape Breton to
 Northwest Territory, south to District of Columbia, Ohio, and
 Iowa. [Europe and Asia.] June–September.



FIG. 299. *Agropyron scribneri* Vasey; Beal, Grasses N. Am., 2: 638.—A densely caespitose perennial 2 to 5 dm. high, with ascending culms, flat leaves, and bearded spikes 5 to 7 cm. long, which readily break up at maturity.—Summits of mountains (alt. 1,800 to 4,200 m.), Montana to Colorado and Arizona. August.



FIG. 300. *Hordeum boreale* Scribn. & Smith, Bull. 4, Div. Agrost., 28 (1897). NORTHERN WILD BARLEY.—A slender, erect and apparently perennial grass 3 to 6 dm. high, with rather broad, flat leaves, smooth culms and terminal spikes 7 to 10 cm. long.—Mountains of California to Alaska and Bering Sea islands. June, July.



FIG. 301. *Elymus arenarius* L. SEA LYME-GRASS.—A stout, erect perennial 6 to 12 dm. high, with extensively creeping rootstocks, rather firm, flat, sharp-pointed leaves and terminal, usually densely flowered spikes 8 to 25 cm. long. Glumes usually villous:— In maritime sands, Greenland and Labrador to Maine; Alaska to California and on the shores of the Great Lakes. [Europe and Asia.] July, August.



FIG. 302. *Asperella hystrix* (L.) Moench (*Asprella* W. not Schreb.; *Hystrix patula* Moench; *Gymnostichum hystrix* Schreb.). BOTTLE BRUSH.—A smooth, caespitose perennial 6 to 12 dm. high, with rather broad, flat leaves and terminal spikes 6 to 12 cm. long. Spikelets widely spreading at maturity.—Fertile, rocky woods, New Brunswick and Ontario to Georgia, Alabama, Arkansas, and Minnesota. June-August.

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